THE IRON AGE

New York, January 5, 1922

ESTABLISHED 1855 VOL. 109, No. 1

Lowest Output in Relation to Capacity

Nineteen-Twenty-One a 38 Per Cent Year in Steel—Steadily Declining Prices, But High Costs Due Largely to High Freights and Restricted Operations

THE iron and steel industry entered 1921 well persuaded that the depression that came upon it three months before the end of 1920 would grow more acute in the new year. Yet it is truth to say that no prophecy made at the beginning of 1921 went so deep into depression as both prices and production went, as the result of the year's developments.

Prices declined steadily throughout the year, with an occasional eddy unrelated to the general trend, and the plotted curves for rolled steel are all at high point in January and at low point in December. The production curve is different. Its high point is in January, but its low point is in July, while December is about half way between the two.

Hopes of Rebound Dashed

Just as in the second half of 1919 and the greater part of 1920 most manufacturers believed that the war reckoning had been dodged, because it did not come as soon as they expected, so in the early months of the present depression there was a belief that the demand for iron and steel dropped off so precipitously in the fall of 1920 that some rebound was inevitable. The spring of 1921 was the time generally set for renewed buying, and the theory was that as restriction in output, particularly in pig iron, had been drastic, there might be some stiffening in prices along with the revival in demand. All such hopes were disappointed.

At the beginning of April it was said in THE IRON AGE'S market summary: "Production [of pig iron] to-day is the smallest on record in proportion to the country's capacity." The same statement could have been made in succession at the beginning of May, June, July and August. But in August the turn came and for four months there was a succession of increases in output. Steel ingot production likewise was at low point in July.

1921 in Iron and Steel

A YEAR of severe depression, of steadily declining prices, of unemployment and successive wage reductions for workmen, and of heavy losses for iron and steel companies.

Output was on a smaller scale, in relation to capacity, than in any other year in the history of the industry.

Pig iron production was about 16,400,000 *tons,* 44 *per cent of the* 36,925,000 *tons of* 1920. *We must go back* 13 *years, or to the* 15,936,000 *tons of* 1908 (*the year after the last panic*), *to find so small a pig iron year.*

Steel works produced about 19,250,000 *tons of ingots, against* 40,881,000 *tons in* 1920. *In terms of the country's ingot capacity,* 1921 *will rate as a* 38 *per cent year.*

The decline in prices was from an average of 3.082c. *per lb. on Jan.* 1, *for the seven leading forms of finished steel, to* 2.062c. *per lb. on Dec.* 31. *At the beginning of the year the average of these seven products stood at* 85 *per cent, and at the close of the year at only* 24 *per cent, above the* 1913 *average.*

Using Up Stocks to the Utmost

The one thing in the record of 1921 as a steel year that stands out above all else, and that was continually a marvel, was the way in which consumers got along without going to the mills. There was much more steel in the country, in the hands of jobbers, manufacturing consumers and others than had been thought. The country never got along before on a 38 per cent operation of its steel capacity and it would not have done so last year but for using up to the last ton what was carried over from 1920. Thus the effort of consumers in all lines to reduce their steel inventory to the lowest point dominated mill operations. As prices steadily declined resort was had to every expedient to avoid drawing on the mills for fresh supplies. Railroads shipped steel across the country from one repair shop that had fair stocks to another that had little. Jobbers in iron and steel traded with competing jobbers, shipping sizes and forms in which they were overstocked in exchange for sizes and forms of which they had little. Steel companies at times shipped from their warehouses at mill

prices rather than start up a mill for a meager rolling on which delivery was due.

Blast furnace yards were full of ore bought at the high prices of 1920. Throughout the year such stocks were a heavier and heavier incubus on the ore and pig iron markets. As illustrating the inclination of the whole trade, particularly in the early months of the year, to take the most hopeful view possible of the future, the estimate was common at the end of March, and it appears in our market summary of March 31, that "less than 40,000,000 tons of Lake Superior ore will be shipped this season," seeing that fully 31,000,000 tons was then in furnace yards and on docks. "Less than 40,000,000 tons" was quite correct! But there was no idea on March 31 that the season's movement down the lakes would turn out to be so little as 22,300,000 tons.

Consumers Turn Jobbers

An unprecedented thing was added to all the other influences at work to restrict demand for steel. Along in the second quarter of the year large manufacturing consumers turned jobbers, selling off bars, plates, structural shapes, or whatever they had on hand, at less than warehouse prices. Many of the Steel Corporation's contracts of 1920, taken at much below prevailing prices, were written down as firm orders and the buyers took the deliveries when due. In some cases they could not use the steel, but generally the reselling was prompted by the belief that it could be replaced later at lower prices.

Steel Corporation and "Independent" Prices

The low prices maintained by the Steel Corporation in 1919 and 1920, ranging from $10 to $30 per ton below those of independent steel companies in different products, extended their influence into 1921—but not for long. The year opened with the Steel Corporation operating at 85 to 90 per cent of capacity. Independent companies, which for many months in 1920 had sought prompt rather than contract business, had little work ahead and early in January ran at less than half the Steel Corporation's rate. Later in that month independent mills operated at but 20 to 30 per cent of capacity. Some followed the plan of shutting down certain mills altogether, then after two weeks or so starting up to take care of orders that had come in.

The difference in the position of the Steel Corporation and the independents early in the year will appear from the fact that in December, 1920, the latter curtailed pig iron production by blowing out 19 furnaces, whereas the Steel Corporation had three more furnaces at work on Jan. 1 than on Dec. 1. In January the independents blew out nine more furnaces while the corporation blew in one. In February, however, the Steel Corporation was made to feel the effects of the universal contraction, its list of active blast furnaces suffering a net loss of 15 in the month.

At the beginning of the year the Steel Corporation was still adhering to the so-called Industrial Board prices of March 21, 1919. But only a few weeks had passed before the independents went lower. In the first week of February the Midvale Steel & Ordnance Co. announced that it would quote prices low enough to bring business to its mills, some of which had been shut down since early December. Cuts of $5 per ton below the Steel Corporation schedules came promptly, the products chiefly affected being plates, shapes and bars. The decline went on for several weeks, the Steel Corporation meanwhile maintaining the prices to which it had adhered for about two years.

By April 1 plates had declined from 2.65c. on Jan. 1 to 2c., beams from 2.45c. to 2c. and bars from 2.35c. to 2c. On April 12 the Steel Corporation announced that it had decided to make substantial reductions, putting bars at 2.10c. and plates and shapes at 2.20c. Billets were reduced from $38.50 to $37, wire rods from $52 to $48 and tin plates from $7 to $6.25 per box. At the same time independent companies, which had been selling below these prices, advanced their quotations to those announced by the Steel Corporation. It was apparent in May that these prices were not holding, some plate mills having made a 2c. price, while bars were sold at 1.90c. Pittsburgh. These price cuts did not increase the volume of business, there being no evidence of a stabilizing influence.

On July 5 the Bethlehem Steel Co. announced reductions amounting to $4 per ton for bars, plates, shapes, billets, skelp, sheet bars and blue annealed sheets, $5 for black and galvanized sheets, and $10 for tin plate. On some products this announcement merely recorded what the market already had done. In mid-July aggressive competition between the Steel Corporation and independent steel producers developed in the Chicago market, Pittsburgh basing having gone by the board in that district.

Through the remainder of the year prices kept on declining. One small counter current was started by an advance of $2 to $3 per ton in wire products, made by the Steel Corporation, effective Sept. 10. The real effect of this advance was to bring a large amount of business on its books at prices previously prevailing, which were $2.75 per keg for wire nails and $2.50 per 100 lb. for plain wire. While considerable business was done later at the advanced prices of $2.90 for nails and $2.60 for plain wire, it turned out that these prices were not really enforced. Later in the year there was considerable cutting in wire products and on Dec. 21 the Steel Corporation announced formal reductions to $2.50 for wire nails and $2.25 for plain wire.

There was a jog in the pig iron price line, most noticeable in the Eastern market. Low point was reached in all pig iron markets in August, and in some a slight turn upward came in September, lasting through October. In November prices began falling away again and the decline continued through the year.

Uneconomical Operation

Throughout the year steel companies were constantly at work to get costs down. Naturally wages were reduced, as will be referred to later. But economies in operation were enforced, such as were not possible in the strain for output which marked most of the months of 1920. Crews were recast, and in some instances mill foremen were given such general orders as, Use five men to do the work formerly done by six. Fuel economy was studied anew, in view of the war wages paid at coal mines and the high freight on coal. New economies were found in the use of refractories, lubricants and all other supplies, on which costs had run up beyond all precedent. Per capita output was increased in some classes of operations. At blast furnaces accumulated flue-dust piles were made available by sintering, replacing in some cases considerable percentages of high priced ore in blast furnace mixtures.

But every effort at economy, even that secured by the easiest and least desirable route of wage cuts, met eventual defeat at the hands of High Unit Overhead. All that steel producers had learned of the incomparable value of large tonnages as a divisor into fixed charges had to be forgotten. Small runs, spasmodic starting and stopping of mills, and at all times fractional operation of producing capacity were insuperably baffling. Cases are known in which, rather than start up a mill to make a scheduled delivery, the producer bought the material from a competing company. The latter got the benefit of a longer run, which helped

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its cost, while steel company No. 1 was able to buy at less than it would have cost it to start its mill.

Sources of Demand

The railroads are credited with consuming each year a large percentage of the country's steel output. They did not consume much last year, as is told below, but it is to be said in passing that the railroad consumption of steel is always exaggerated in the general thinking. It is doubtful if it has gone above 25 per cent in any year in the past 20, apart, possibly, from 1906 and 1907, and commonly it is not above 20 per cent.

Throughout the year it was the constant comment in market reports that in the heavy products—rails, plates, shapes and bars—demand was indifferent. The lighter products did better—wire, sheets and tin plates. On the whole, there was a good business, particularly in the second half, in wrought pipe. The new oil fields of Texas and the revival in the petroleum market after a period of flatness brought out some good contracts for line pipe.

What saved the day for plate mills, in the small demand from shipyards and car works, was the unusual amount of tank work called for by the oil fields, particularly the Mexia field of Texas. In the second half of the year tank works in the West and Middle West were unusually busy on this account.

New construction, commonly called an index of activity in steel, was held back by excessive labor cost. There was a good deal more house building throughout the country than was commonly credited. This is established by the fact that foundries making heating furnace castings ran at a much better rate than others and that radiator companies really had a good year. Manufacturers of sanitary equipment and builders' hardware fared well also. A good deal was done in the erection of school houses and other public buildings, but not much in business structures, and very little in bridges. The bookings of the fabricating companies averaged for the year about one-third of their capacity.

Agricultural implement warehouses were pretty well stocked with machinery throughout the year, and manufacturers in these lines did little. No large buying of steel from that quarter is to be looked for until the farmer gets on his feet, and that will not be until after the next harvest. The automobile demand was about what was expected of it—considerably less than half that of 1920.

Replenishment demand, after months in which the country had been swept bare of steel in all forms, caused the larger operation of steel works and rolling mills that dates from the early fall of last year.

Meager Demand from Railroads

Railroad buying in 1921 was most disappointing. From early in the year until its end steel producers held to two main hopes, neither of which was realized. One was that the Government's settlement of the railroad claims for losses during the period of control would give them means with which to buy equipment and do track work, thus helping the steel mills in their time of need. The other was that freight rates would be put down and the steel trade relieved in part of the heavy burden of transportation charges nearly double those of pre-war time.

The special hardship of the 40 per cent rate increase of August, 1920, on the raw material of steel making was put before the carriers time and again. Many of them conceded the force of the argument that there is no parallel in other industries for the hauling, often for long distances, of five tons of raw material for the making of one ton of finished steel product. But the railroad presidents were so engrossed with issues growing out of their relations with the labor unions that they could not take the plight of the steel industry into their thinking. Nor could they be made to see how far any increased buying of steel that might result from lower freight rates on its raw materials would go in improving their own business.

From time to time predictions of betterment in the steel trade were put out, on the promise of legislation, favored by the administration at Washington, for the funding of $500,000,000 of railroad indebtedness to the Government for property expenditures in the period of control. But this legislation never came through. Various settlements were made on war-time claims of the railroads against the Government, and following these there were belated payments of railroad obligations to the steel mills. Substantial relief to the railroads came in a 12½ per cent wage reduction on July 1 and in changes in shop rules made by the Railroad Labor Board in December, working savings of many millions of dollars per year.

Out of all the expectations of railroad buying entertained at the opening of the year the actual outcome was far below that of 1920. And 1920 was a year in which the railroads directly and indirectly, consumed not more than 15 per cent of the country's steel output. New cars ordered were only a fraction of the 84,000 placed in 1920, being only about 20,000, and locomotives ordered for domestic use were fewer than 250. The repair of 40,000 cars helped in a measure to make up to the mills what they missed in steel for new cars.

Production

The output of iron and steel in 1921 was the smallest since 1908, which was the year following the panic of November, 1907. Pig iron production last year we estimate at 16,400,000 tons and steel ingot production at 19,250,000 tons. Counting ingot capacity at 50,500,000 tons 1921 was thus a 38 per cent year. The output of steel ingots and steel castings together was probably not far from 19,850,000 tons. Comparison with the five preceding years is made in the table below:

	Pig Iron Gross Tons	Steel Ingots and Castings Gross Tons
1916	39,434,797	42,773,680
1917	38,621,216	45,060,607
1918	39,054,644	44,462,432
1919	31,015,364	34,671,232
1920	36,925,987	42,132,934
1921	16,400,000*	19,850,000*

*Estimated

The variations in pig iron production appear in the following statement of the number and daily capacity of the furnaces in blast at the beginning of each month:

	No. in Blast	Daily Capacity Gross Tons		No. in Blast	Daily Capacity Gross Tons
Jan. 1	201	76,540	July 1	76	32,195
Feb. 1	183	70,500	Aug. 1	69	29,175
March 1	153	61,850	Sept. 1	70	30,170
April 1	102	41,530	Oct. 1	82	35,650
May 1	96	39,105	Nov. 1	96	43,500
June 1	90	37,085	Dec. 1	120	51,665

In the low month of the year, July, 864,555 tons of pig iron was made. Not in 17½ years had any month yielded so low a total. In December, 1903, the country produced 846,695 tons.

The Year's Iron and Steel Exports

Starting in under the momentum of the 1920 movement which made the January total 547,394 tons, the export of iron and steel from the United States tapered down rapidly until in August, with 75,827 tons, a figure was reached lower than for any month since January, 1909. An encouraging but slow growth after August, month by month, brought the figure to 122,290 tons for November, which is 28.2 per cent of the November, 1920, movement. Up to Nov. 30 the total was 2,075,674 tons, or 47.15 per cent of the 4,402,056 tons for the first eleven months of 1920.

In only two items did the shipments last year exceed those of 1920 these being welded pipe and fittings,

(*Continued on page* 53)

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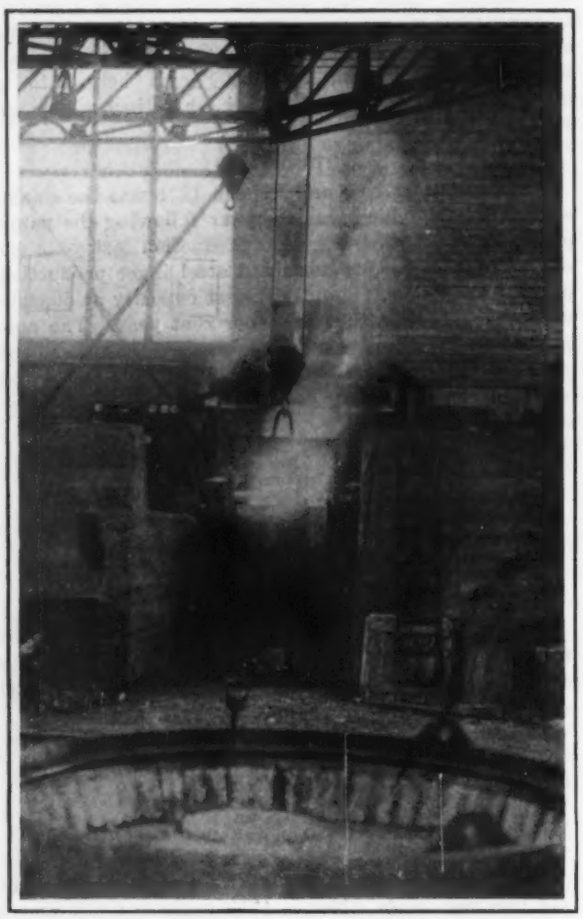
Manganese Steel Made in Electric Furnace

Melting Practice for Castings Discussed—Use of Manganese Steel Scrap—Deoxidizing with Manganese Ore—The Heat Treatment

BY LARRY J. BARTON*

THE electric furnace has again shown its superiority over other steel-making methods. This time it is in the field of manganese steel. Up to a few years ago all of the American production of this metal was by means of the converter, the ferromanganese being added molten in the ladle. One company has made extensive trials with the electric furnace, over the last three years. Its results have been so gratifying that they have decided to replace all the



Tapping a Heat of Manganese Steel from an Electric Furnace in the Plant of the Southern Pacific Co.

converters with electric furnaces. Manganese steel, made in the converter, was considered very good steel, but electric steel is so superior in every way, that it might be considered a "super-manganese steel." The following paper is intended to cover this subject in detail.

Production and Uses

Manganese steel was first brought to the attention of the steel world by the researches of Sir Robert Hadfield, in England, about the year 1887. Its first introduction into the United States was in 1892 in the form of manganese steel castings. Since that time there has been a gradual increase in the tonnage until the present time, when about 100,000 tons is the yearly capacity. This product is being shipped in quantity to all parts of the world, from the gold mines of Alaska to the great dredgers of South America. The great work of the Panama Canal was only made possible by the use of this metal.

Manganese steel is a steel of many uses. Being one possessing great wearing qualities and toughness, it finds unlimited use where abnormal strength is required. Dredge pins and buckets, rolling mill pinions, crusher parts, crane wheels, sheaves, tractor links, railroad frogs and switches, are some of its more important uses.

Physical Properties

Manganese steel, when heat treated, has the following properties as the result of a large number of tests:

Tensile strength, lb. per sq. in.	100,000 to 110,000
Elastic limit, lb. per sq. in.	50,000 to 55,000
Elongation in 2 in., per cent	30 to 35
Reduction in area, per cent	35 to 40
Brinell hardness	180 to 200
Scleroscope	40 to 50

Manganese steel is practically non-magnetic, and for this reason finds great use as a protecting plate on electric magnets. Most of the steel parts on the famous North Pole "non magnetic" ship were made of manganese steel.

Its shrinkage is about 5/16 in. as against ¼ in. for soft steel. This makes it a much more difficult metal to cast from the standpoint of the molder. Manganese steel when solidifying is prone to crack and check, and for this reason all corners or sharp edges are avoided wherever possible. Many castings must be shaken out while red hot and the cores broken in to overcome this trouble. Due to its great solidity

*Table of Tests of Manganese Steel of Varying Compositions or Forged Steel Containing 0.83 to 19.0 Per Cent Manganese**

Composition, Per Cent				Natural		Quenched in Water		Annealed	
No. of Sample	Carbon, Per Cent	Silicon, Per Cent	Manganese, Per Cent	Ultimate Strength, Lb. per Sq. In.	Elongation in 8 In., Per Cent	Ultimate Strength, Lb. per Sq. In.	Elongation in 8 In., Per Cent	Ultimate Strength, Lb. per Sq. In.	Elongation in 8 In., Per Cent
1	0.20	0.03	0.83	73,920	31	.....	..	.....	..
2	0.40	0.15	2.30	125,440	6	.....	..	.....	..
3	0.40	0.09	3.89	85,120	1	.....	..	.....	..
4	0.52	0.37	6.95	56,000	2	51,520	2	47,040	2
5	0.47	0.44	7.22	60,480	2	56,000	2	60,480	5
6	0.61	0.30	9.37	73,920	5	87,360	15	85,120	16
7	0.85	0.28	10.60	76,160	4	89,600	17	91,840	17
8	1.10	0.16	12.60	87,360	2	120,960	27	82,880	11
9	0.92	0.48	12.81	87,360	5	136,640	37	107,520	20
10	0.85	0.28	14.01	80,640	2	150,080	44	107,520	14
11	1.10	0.32	14.48	87,360	1	141,120	37	109,760	5
12	1.24	0.16	15.06	109,760	2	136,640	31	105,280	2
13	1.54	0.16	18.40	114,240	1	118,720	10	87,360	1
14	1.83	0.26	18.55	96,320	1	123,200	5	.....	..
15	1.60	0.26	19.10	116,480	1	132,160	4	91,840	1

*Hadfield, *Journal Iron and Steel Institute*, vol. II, 1888, p. 70.

*Metallurgist Southern Pacific Co., Sacramento, Cal.

the shrink heads on castings must be larger than on carbon steel castings, and the gating must be very carefully done to avoid tearing during the cooling period.

Its Manufacture

The steel being described was made in a standard 3-ton Heroult furnace. This furnace was lined in the ordinary way, basic bottom, basic brick to above the

Part of a Battery of Heat-Treating Furnaces for Manganese Steel Castings

slag line, with silica brick from there up and a silica brick roof. Due to the heavy reducing conditions and the large amount of lime necessary in the slags, the life of the linings and roof are much less than on carbon steel. This has been overcome to a great extent by the use of what are known as "metalkase" brick. These are a metal lined magnesite brick which do not spall and give superior service when lined directly to the roof.

Manganese steel generally runs from 11 to 13 per cent manganese, with carbon 1.10 to 1.30 per cent. The main point in its successful manufacture is to keep the carbon always below this proportion, and if possible lower. Disregarding the remelting of manganese steel scrap, which will be taken up later, there are several methods of furnace practice available.

1. The metal can be melted under an oxidizing slag, the slag removed, a second slag added, and cleared under a heavy reducing atmosphere, as if carbon steel were being made. When the slag is white and powdering, the ferromanganese can be added in lots of several hundred pounds at a time and the bath brought to the proper temperature and tapped.

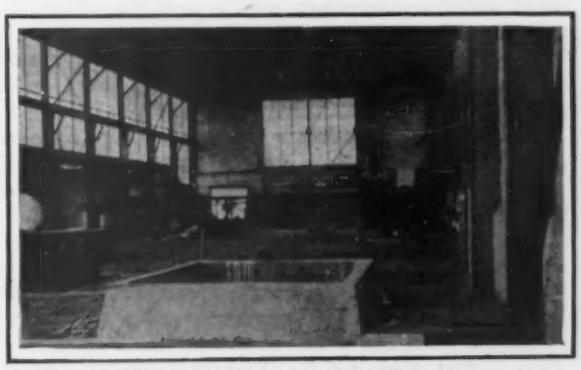
2. The heat can be run as above, adding the manganese after slagging off, before the final slag.

3. The heat can be melted, the manganese added and the steel finished under the first slag.

In the first two methods all the manganese in the charge is wasted, flowing from the furnace in the first slag. This is saved by the third method. Then, too, there is a considerable saving of slag-making material by using the last method. The only objection to this method is the fact that if you melt down high in carbon you are faced with an off analysis. By carefully watching the charge and melting, this is a point which very seldom happens, and then only when having electrode breakage. Under the circumstances the last method has been adopted as the standard practice.

Melting Practice

The charge is either shoveled or thrown by hand into the furnace, depending on its character, care being taken that the scrap is so arranged that it forms as compact a mass as possible. This is an important point, especially in a shop where heavy penalties are imposed by the power company on high peak loads. The more compact the charge, the easier the melting down and the quicker the time for a steady load to be obtained. The lime, generally about 2 per-cent of the charge, can either be added with the charge or as the bath is melting down. During the melting the rust and scale on the scrap reacts on the carbon, manganese and silicon, cutting them down according to the reactions:

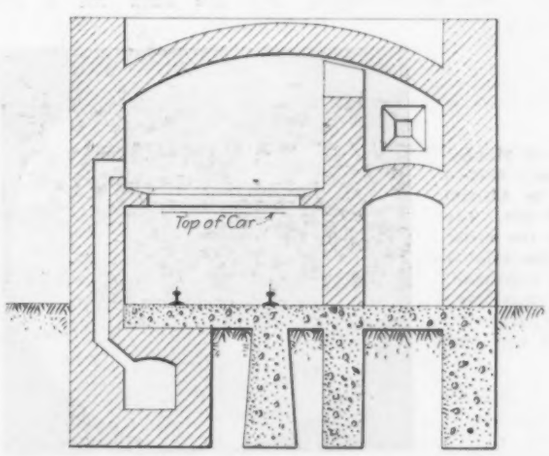


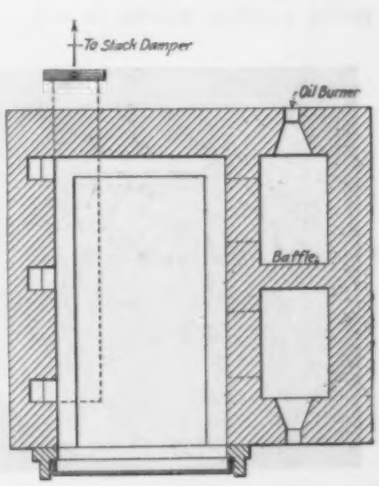
Quenching Tank for Treating Manganese Steel Castings

$$Fe_2O_3 + 3C = 2Fe + 3CO$$
$$2Fe_2O_3 + 3Si = 4Fe + 3SiO_2$$
$$2Fe_2O_3 + 3Mn = 4Fe + 3MnO_2$$

When using ordinary soft steel scrap containing carbon, 0.20 to 0.30; manganese, 0.30 to 0.50, and silicon, 0.05 to 0.20 per cent, the bath will melt down without any further additions of ore or scale to about carbon, 0.03 to 0.08; manganese, 0.05 to 0.10, and silicon, 0.01 to 0.03 per cent.

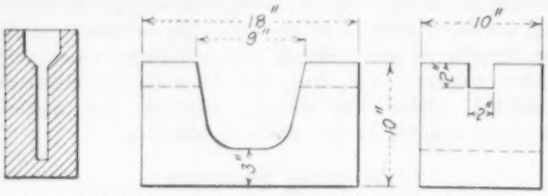
If a heat of low phosphorous is desired it will of course be necessary to draw off the first slag. As the phosphorous limit of around 0.06 to 0.08 per cent in manganese steel is easy to meet, it will not be necessary





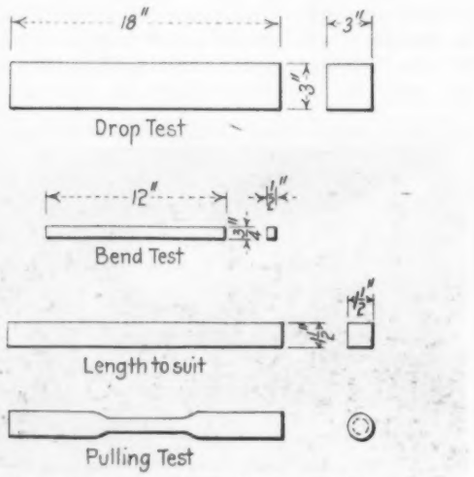
End Section (Left) and Sectional Plan (Right) of Heat-Treating Furnace for Manganese Steel

to do this except in unusual cases. When the charge is all melted, any pieces of metal on the side walls are knocked into the bath and a preliminary test for



Mold (Left) for Test Bars and Bending Block (Right) for Bending Manganese Steel Bars

carbon taken. This can be either a fracture test by eye or can be a quick analysis by the chemist. As it is so easy to tell by a fracture test, the chemist is very seldom used for this preliminary. If your carbon is as low as desired it is time to go ahead. If not, scale or



Test Bars for the Various Tensile, Bending and Drop Tests on Manganese Steel

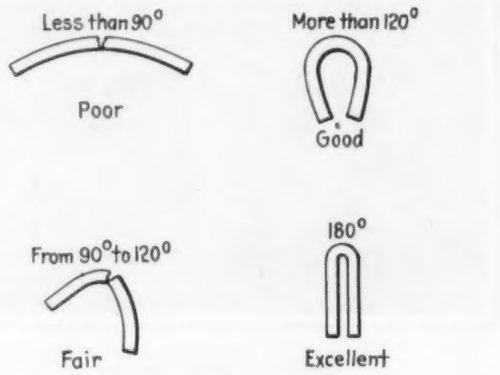
ore must be added, the bath boiled and the carbon burned out until the test shows the carbon is low enough. The required amount of ferromanganese having been weighed out to give the desired analysis, it is added at the rate of 100 lb. per min., each lot being added through alternate sides of the furnace.

The slag is now given a dusting of coke dust or some other reducing agent and the final period begins. The slag slowly begins to turn from a black to a brown, then greenish gray, and is finally white, powdering to a fine powder in the air. This is not always the case, however, as the slag may hang up and remain a green or a blue throughout the heat. The best indication is the metal test, disregarding your slag entirely. This test is taken in a sand mold, made of two cores pasted together, poured on end. While still red hot this test is quenched in water and broken on a block. If the bend is good the metal is ready to pour. If not, the bath must be held under further reduction and deoxidation takes place, according to the reactions:

$MnO + CO + C = Mn + 2CO$
$SiO_2 + CO + 2C = Si + 3CO$
$FeO + CO + C = Fe + 2CO$

the metals being reduced back into the bath and the oxygen going off as a gas.

Under the influence of this heavy reducing atmos-



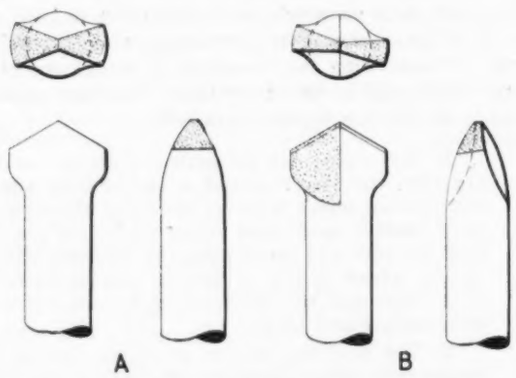
Method Used in the Recording of Heats by Means of Bending Treated Test Bars

phere, together with the large amount of lime in the slag, nearly all of the sulphur is eliminated from the metal. This may take place in several ways:

$FeS + CaO + C = Fe + CaS + CO$
$2CaF_2 + 2FeS + Si = 2CaS + SiF_4 + 2Fe$
$FeS + CaO = CaS + FeO$
$3FeS + 2CaO + CaC_2 = 3Fe + 3CaS + 2CO$

Testing the Temperature

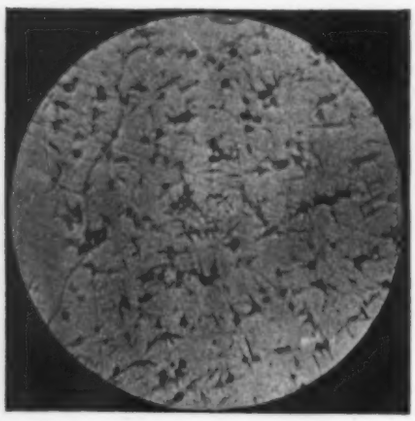
Assuming the metal test is now satisfactory the

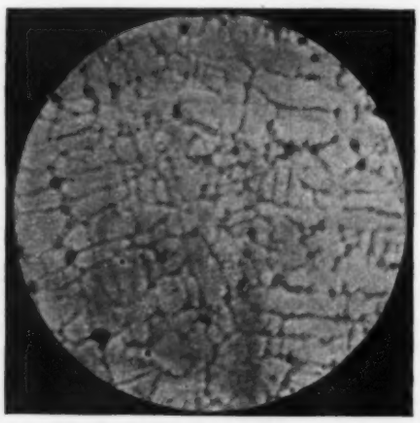


Special Tool for Drilling Manganese Steel Samples

steel is examined as to temperature. This can be ascertained in several ways:

1. By means of the rod test. A soft steel rod is immersed into the bath for a pre-





Photomicrographs of Manganese Steel Castings; Etched with Nitric Acid in Alcohol and Magnified 125 Dia. The one at the left is the metal as cast and the other (right) is the steel after treatment. The composition was Mn., 11.89; C., 1.28; Si., 0.24; P., 0.04, and S., 0.02 per cent

determined number of seconds and the effect of the heat noticed by the way the end of the bar is eaten away. If cut off clean the metal is hot; if cut pointed the metal is medium, and if not cut at all or sculled the metal is cold.

2. By means of pouring over the lip of a small test spoon and noticing how clean the spoon pours, together with the appearance of the metal to the eye.

3. By means of drawing a spoon full of metal and taking the number of seconds necessary for the top of the metal to skin over.

The last method is the one now in use and the required number of seconds is close to 60. This test is reliable only when there is over 0.50 per cent silicon in the metal and as soon as the spoon is taken from the furnace small pinches of ground silicon are added to give this condition. While this test varies according to the initial heat of the spoon before filling with metal, in the hands of the same operator it proves very reliable.

When the steel is hot enough it is tapped, the ferro-silicon being added in small pieces to the ladle. Tea pot ladles are used and give very good service.

Analysis of Slags

The following shows the analysis of a few slags, recording the difference as the heat progresses:

	1 P.M. Dark Brown	2 P.M. Brown	2:10 P.M. Light Brown	2:45 P.M. White Powder
	Per Cent			
Silica	28.02	34.70	33.50	33.60
Iron oxide	20.70	16.00	10.00	9.40
Aluminum oxide				
Lime	48.38	49.49	56.45	58.42
Magnesia				
Manganese oxide	7.02	4.45	3.75	1.59

Some slag losses on different heats are as follows:

Manganese in Steel, Per Cent	Manganese in Slag, Per Cent
10.53	6.45
11.11	6.67
11.92	2.79
11.26	3.91

These were all on heats where the slag was difficult to clear and where the metal test alone was used to show condition of metal.

Logs of the Heats

Some of the actual heat logs were as follows:

Heat No. —

Charge	Lb.	Steel Analysis, Per Cent	
Heads and gates (carbon steel)	800	Mn	11.62
Punchings	3,000	C	1.26
Turnings	650	P	0.055
Total	4,450	Si	0.45

Time of heat, 4 hr. 55 min.
Kwh. used, 3500

Time
10:20 Power on. Low amperage; voltage 104 to 106
10:35 Power off to lower electrodes
10:45 Power on. Amperage 4500
11:10 3 shovels lime, 60 lb.
1:20 Amperage reduced to 3500; 60 lb. lime added
1:40 All melted
2:05 First metal test, carbon 0.12 per cent. Slag dark brown
2:15 25 lb. of ground electrodes added
2:18 Changed to low voltage, 83
2:25 Slag white
2:30 High voltage, 106
2:32 100 lb. ferromanganese on hearth at each door
2:40 First 100 lb. in No. 1 door; second 100 lb. heating
2:44 First 100 lb. in No. 2 door; second 100 lb. heating. Amperage increased to 4500
2:48 to 3:08 Manganese added 100 lb. at a time from alternate doors
3:15 Tapped
Weight of metal, 5100 lb.
Weight of slag, 310 lb.

Heat No. —

Charge	Lb.	Steel Analysis, Per Cent	
Heads and gates	500	Mn	11.02
Punchings	4,100	C	1.33
Turnings	500	P	0.046
Total	5,100	Si	0.56

Time of melting, 6 hr.
Kwh. used, 3900
9:30 Power on. 3000 amperes; voltage, 100 to 102
9:45 75 lb. lime added; 4500 amperes
11:15 15 lb. lime
1:00 60 lb. lime
1:30 First metal test for carbon, 0.30 to 0.35 per cent on fracture; slag, black
1:40 Hole in roof
1:50 60 lb. mill scale; 2500 amperes
2:05 Carbon, 0.35 per cent by analysis
2:10 45 lb. mill scale
2:15 Carbon, 0.35 per cent
2:20 30 lb. mill scale
2:30 Slagged off
2:35 100 lb. lime
Up to 3:10 Manganese added
3:20 10 lb. ground electrodes
3:30 Tapped

Weight of metal, 5655 lb.
Weight of slag, 350 lb.

Analyses of the carbon electrodes used was as follows:

	No. 1, Per Cent	No. 2, Per Cent
Moisture, etc.	1.19	None
F.C.	98.00	99.17
Ash	0.81	0.83
SiO_2	0.49	0.12
Fe_2O_3	0.12	0.26
Al_2O_3	None	0.08
CaO	None	0.17
MgO	None	0.13
S.	0.20	None

Remelting of Manganese Steel Scrap

This is the one great point where the electric furnace shows its superiority over the older processes. Under the old system this scrap was remelted in an air furnace, very similar to an open-hearth, with the exception that there are no regenerative chambers. These furnaces were also used to melt the ferromanganese. Large losses of manganese occurred, with the resulting raise in the proportional carbon content, giving great trouble in keeping the carbon low in the final metal. With the electric furnace this is larely eliminated. The scrap consisting of old heads and gates, defective castings, etc., is melted the same as ordinary carbon steel scrap under a heavy lime slag. Then towards the finish of the heat all this manganese in the slag is reduced back into the bath.

The best success is obtained when the charges are rattled and cleaned from all adhering sand and scale. This lowers the oxidizing condition of the melting down period, tending to lessen the manganese slag contents. When the bath is melted, a sample is taken for the chemist to analyze for carbon and manganese. From this analysis the resulting charge of ferromanganese is calculated. These tests cannot be taken by fracture as the high manganese content of from 6 to 10 per cent changes the grain to such a point that any estimate is unreliable.

Some Heats of Manganese Steel Scrap

Manganese scrap, per cent	50.0	70.0	80.0	70.0	50.0
Condition	Rusty	Rusty	Rusty	Rattled	Rattled
How charg'd	Center	Top	Top	Center	Center
Current on	8:45 a.m.	9:35 a.m.	3:35 p.m.	3:35 p.m.	1:15 p.m.
Contact	9:15	10:05	6:05	At once	At once
Melted	11:10	1:15	7:35	6:15	3:45
Tapped	12:15	2:20	9:00	8:05	6:15
Total time	3:30	4:45	5:25	4:30	5:00
First charge:					
Mn ore	None	12:00	6:35	4:55	2:45
Scale	10:55	11:05	6:45	6:05	3:45
CaF_2	11:20	12:50	6:55	5:35	3:55
Lime	9:55	11:05	7:00	....	3:05
Sand	11:15	1:05	7:25	6:35	4:25
Coke	11:15	12:55	7:35	6:35	4:25
FeSi	....	2:05	8:55	7:00	4:35
Total Lb.:					
Mn ore	None	60	60	170	150
Scale	60	30	30	95	80
CaF_2	20	15	25	40	40
Lime	85	145	190	215	250
Sand	15	30	25	25	15
Coke	85	155	85	110	120
FeSi	30	25	25	50	45
FeMn	630	332	324	395	610
Final slag	....	....	Light green	Light green	Bluish green
Final temp., sec.	60	40	60	40	45
Mn. per cent, theoretical	13.43	13.29	14.14	13.22	13.25
Mn. per cent, actual	13.23	11.86	12.14	12.55	12.50
C, per cent, theoretical	1.30	1.25	1.33	1.29	1.29
Side walls: Before	OK	Thin	Thin	OK	OK

After Bottom:	OK	Thin	Thin	Cut	Cut
Before	Hole	OK	OK	OK	OK
After	Hole	OK	OK	OK	Cut
Metal tapped, lb.	6,430	5,655	6,010	6,200	6,400
Kwh. total	2,500	2,500	2,500	3,000	3,000
Kwh. per ton	812	887	833	968	938
Time per ton	1:05	1:40	1:50	1:25	1:35

The above data were collected during the experimental period on remelting manganese scrap and the results are not as good as future practice developed, especially upon such points as time and power. Since that time many heats of 100 per cent returned scrap have been melted with no difficulty. This process is the greatest event in the history of manganese steel making, as it allows for the remelting of shop scrap and old worn out castings with no loss of the manganese alloy.

Manganese Ore as a Deoxidizer

When ore or mill scale is used to cut the carbon it is a known fact that the manganese is also oxidized and goes into the slag as MnO. It was therefore decided to try manganese ore in place of the mill scale. Theoretically this would cut the carbon and yet leave a high residual manganese in the steel, according to the reaction

MnO_2 plus 2C equals Mn plus 2CO.

This was tried with a heavy blue black manganese ore analyzing 50 per cent metallic manganese.

Manganese Ore versus Mill Scale

	Manganese Ore	Mill Scale
Number of heats taken for comparison	13	13
Average weight shop scrap in charge, lb.	1,421	1,290
Average weight total charge, lb.	7,225	6,827
Average weight total pour, lb.	7,028	6,661
Average melting loss, per cent	2.7	2.4
Manganese ore added per heat, lb.	36	..
Average manganese in total charge, per cent	12.68	12.53
Average manganese in steel by analysis, per cent	11.61	12.11
Average manganese loss on total charge, per cent	8.45	3.35
Average carbon in steel by analysis, per cent	1.03	1.09
Average manganese-carbon ratio	11.29	11.10
Average preliminary carbon, per cent	0.27	0.19
Average carbon in charge, per cent	0.38	0.37
Average carbon oxidized from steel, per cent	0.11	0.18
Average kwh. per heat	3,154	3,384
Average kwh. per ton of charge	876	936

From these experiments it was found:

That the manganese losses were greater with the ore.

That the preliminary carbons and the final carbons were higher, due to the fact that not as much carbon was oxidized.

That it required less power when using manganese ore.

That the manganese-carbon ratio was better giving a final steel lower in carbon, even though higher at first.

That when the scrap was rattled and free of scale, the results were excellent.

The practice of cleaning the scrap and using manganese ore has now been adopted as standard practice. When used in this manner the ore is highly efficient.

Mn / C	Ore Efficiency, Per Cent	Bend on Test Bar	Mn in Steel, Per Cent	C in Steel, Per Cent
10.30	97.4	Very good	13.88	1.35
11.20	73.5	Very good	11.72	1.05
11.30	90.5	Fair	11.72	1.14
10.50	91.0	No good	11.09	0.96
11.20	86.5	No good	10.76	0.90
10.85	64.5	No good	9.76	0.90
10.70	79.0	Good	11.24	1.05
11.65	101.0	Excellent	12.58	1.08
11.88	100.0	Excellent	12.08	1.02
11.85	90.0	Excellent	12.68	1.05
11.85	91.5	Excellent	11.97	1.01
10.15	96.5	Excellent	12.25	1.21
11.12	88.45		12.00	1.08

The following covers 86 heats, intermittent operation:

Average pour of metal, 6708 lb., or 3.354 tons.
Average charge, 6942 lb., or 3.471 tons.
Melting loss, 234 lb., 0.117 tons, or 2.55 per cent.
Time, 5 hr. 26 min.
Kwh. per ton of steel poured, 1002.
Kwh. per ton poured on first heat of day, 1055.
Kwh. per ton poured on second heat of day, 948.
Highest kwh. per ton of steel poured, 1385; lowest, 700.
Average manganese lost from total charge, 2.16 per cent.
Average manganese lost from ferromanganese, 1.26 per cent.
Average manganese effective from alloy, 98.74 per cent.
Average manganese in charge, 11.80 per cent.
Average manganese in steel, 11.63 per cent.
Average preliminary carbon, 0.18 per cent.
Average preliminary carbon using shop scrap, 0.26 per cent.
Using no shop scrap, 0.10 per cent.
Average pick-up in carbon from 100 lb. ferromanganese, 0.096 per cent.
Average manganese-carbon ratio, 10.77.
Average heats from roof, 25.
Average heats from lining, 35.
Electrodes per ton of steel poured, 33.8 lb.

The thermal efficiency of the furnace is represented by the following formula:

$$\frac{\text{Weight of steel in kilograms} \times \text{specific heat} + \text{latent heat of fusion}}{\text{Kwh. used} \times \text{calories per kwh.}}$$

Using: Latent heat of fusion as 20; specific heat of steel as 470; specific heat of basic slag as 600; slag equals 1/10 of steel by weight; and 1 kwh. equals 860 cal. we found:

Thermal efficiency of furnace, per cent	53.0
Total heat utilized in furnace, per cent	59.5
Total heat in steel, per cent	53.0
In slag, per cent	6.5
In cooling rings, per cent	2.55
Electrode holders, per cent	1.92
Transformers, per cent	1.23
Heat utilized in overcoming cold furnace plus radiation, per cent	34.70

Losses on the cooling rings, electrode holders and transformers were obtained as follows:

	Deg. C.
Water to transformer	19.8
To holder	22.5
From No. 1 holder	26.3
From No. 3 holder	27.3
Temperature of No. 2 could not be taken, drain pipe in the way.	
From No. 1 ring	31.2
From No. 2 ring	32.7
From No. 3 ring	32.9

No. 1 ring.....1 liter water in 4½ sec., or 14 kg. per min.
No. 2 ring.....1 liter water in 4 sec., or 15 kg. per min.
No. 3 ring.....1 liter water in 4½ sec., or 14 kg. per min.

Total..... 43 kg. per min.

Transformer:

(Temp. H_2O to holders — temp. H_2O to transformers) × total kilograms equals calories per min.

(22.5 — 19.8) 43 equals 116 cal. per min.

Holders:

(Temp. from holder — temp. to holder) × kg. equals cal. per min.

No. 1 (26.3 — 22.5) 14 equals	53 cal. per min.
No. 2 (averaged) equals	60 cal. per min.
No. 3 (27.3 — 22.5) 14 equals	67 cal. per min.
Total	180 cal. per min.

Rings:

(Temp. from rings — temp. from holders) × kg. equals cal. per min.

No. 1 ring (31.2 — 26.3) 14 equals	69 cal. per min.
No. 2 ring (32.7 — 22.5) 15 equals	93 cal. per min.
No. 3 ring (32.9 — 27.3) 14 equals	78 cal. per min.
Total	240 cal. per min.

Transformer, $\frac{116 \times 60}{860} = 8$ kwh.

Holders, $\frac{180 \times 60}{860} = 12$ kwh.

Rings, $\frac{240 \times 60}{860} = 16.6$ kwh.

Total..... 36.6 kwh.

4000 amp. × 104 volt × 0.90 power fac. × 1.73 = 650 kw.

Transformer loss, $\frac{8}{650} = 1.23$ per cent

Holder loss, $\frac{12.5}{650} = 1.93$ per cent

Ring loss, $\frac{16.6}{650} = 2.53$ per cent

Grand total..... 5.70 per cent

Heat Treatment of Manganese Steel

Manganese steel in its raw or untreated condition, as taken from the mold, is as brittle as glass and is not suited for any purpose. The castings are cleaned and loaded on small brick topped cars. These are put into the annealing furnaces, which are so built that the top of the car becomes the bottom of the furnace. These furnaces are oil-fired with the flame jets so arranged that a very even and soft flame is obtained.

(*Continued on page* 109)

Brighter Prospects Indicated for 1922

What a Study of Production, Prices, Failures, Finance and Foreign Trade Shows—Activity Evident in Construction—Much Depends on Disarmament

BY NATHANIEL R. WHITNEY, PH.D.*

IN the early part of 1921, the author of this article published a résumé of the business situation in which the obstacles to business revival were outlined as (a) the unsound economic conditions in other parts of the world; (b) the uncertainty as to prices; (c) the excessive issue of paper currency in European countries; (d) the burden of national debts of the world; and (e) the scarcity of capital. It was said that, "the most significant fact upon which to fix attention in endeavoring to predict recovery is the rate of interest for long-time loans. As this rate declines business will improve." Evidence was presented that the situation was already showing signs of improvement and attention was called to the gradual accumulation of capital. It was predicted that, although improvement had begun, the process of recovery would be slow.

Much has happened since that time and the scarcely discernible signs of improvement have now become more clearly marked, but the writer still feels that progress toward recovery will be slow. Anyone who predicts an immediate or rapid return to normal is merely deceiving others and seeking to delude himself. The accumulation of capital, increase in output, decrease in costs of production, readjustment of prices for various commodities to a more normal relation, and elimination or rather reduction of economic and political friction throughout the world—all these require considerable time. It is futile to look for restored prosperity, however, until these requisites are to a considerable extent achieved. But this does not mean that conditions cannot get better—in fact, there is plenty of evidence that they are improving and that they will continue to improve. Progress toward normal is not likely to be continuous; there will be an advance, then a halt or downward trend in certain industries, followed by another advance, and so on, each complete movement carrying business activity to a constantly higher level.

The 1921 Depression in Figures

If we divide the business cycle into the customary four sections—prosperity, decline, depression, and recovery—it is clear that 1920 and the early part of 1921 were in the period of decline. The greater part of the past year was in the depression area, while during the last few weeks of the year the indications pointed to recovery. The year 1921 was one of decline in prices, wages, and profits; of reduction in business activity as shown by bank clearings; of reduced productivity in many lines—iron, steel, bituminous coal, lumber, cotton manufactures. It was a year of record-breaking unemployment and of business failures on a large scale. In short, it furnishes the usual evidence of a period of liquidation.

The index for wholesale commodity prices, which in December, 1920, stood at 189, by the end of July had got down to 148. Since that time a slight advance has been noted. Bank clearings for the year up to the end of the first week in December were about 20.5 per cent less than the clearings for the corresponding period of the year 1920. For the first ten months of 1920 and 1921, the index number for production of bituminous coal was 122.5 and 92.3 respectively; for receipts of lumber at Chicago and St. Louis 82.5 and 74.3; for pig iron production 133.2 and 58.7; for steel ingot production 126.2 and 59.5; for cotton consumption 116.3 and 96.3. The cotton crop for 1921 was estimated to be the smallest since 1895. The production of copper ranged about 20 for 1921. The production of crude petroleum showed a different tendency since the index for 1920 was 191.5 and for 1921 was 207. It is to be understood that normal production in each case is represented by 100. Gross earnings of 184 railroads for the first nine months of the year were 7.83 per cent less in 1921 than for the same period in 1920.

A marked falling off in the value of our foreign trade occurred. For the eleven months ended November, exports for 1920 were $7,508,000,000, and for 1921 $4,191,000,000; imports for 1920 were $5,012,000,000; and for 1921 $2,272,000,000. The excess of exports over imports for 1920 was $2,496,000,000, while for 1921 it was $1,919,000,000. The decline in the physical volume of our trade has not been so marked as these figures would indicate for allowance must be made for changes in the price level.

Earnings of labor during the year have shown considerable reduction although the rate per hour for some groups of labor has not yielded much. The reduction in earnings was due to the elimination of overtime pay, to either a reduced number of working days or complete unemployment, and to reductions in the wage rate for many employees.

The Maladjustment in Prices

The complete story of changes in the price level would not be told unless attention were directed to the uneven decline for different groups of commodities. The following table illustrates these variations. The figures are those compiled by the Bureau of Labor Statistics and are based on the prices of commodities at wholesale. The first column gives the highest figure reached by each group (although it should be noted that these high points for the different commodities were not all reached at the same time); the second column gives the index number for the first of September, 1921.

	Highest	Sept. 1, 1921
Farm products	246	118
Metals	195	120
Food, etc.	287	152
Chemicals, etc.	222	161
Cloths and clothing	356	179
Fuel and lighting	284	182
Building materials	341	198
House furnishings	371	230
Miscellaneous	247	147

An examination of this table demonstrates that the producers of certain of these commodities are at a disadvantage when they purchase from some of the other groups. For example, at the date here given farm products were only 18 per cent while house furnishings were 130 per cent above normal. These are the extremes but it is clear from the figures that there is still maladjustment in the prices of many different commodities. So long as this situation prevails the producers whose commodities have declined most in price will be unwilling to purchase the commodities which are selling much above their normal level. It has been estimated that the farmer's dollar purchases fewer commodities now than it has at any time during

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the past thirty years. The tremendous slump during the past year in the sales of the mail-order houses, a large part of whose business is obtained from the farmers, furnishes striking evidence of the fact that the uneven decline in the prices of the various groups of commodities is responsible for much business stagnation. Fortunately the position of the farmer seems more favorable for the future since the decline in the price of his produce cannot go much further.

Corner Probably Turned

The rapid and uneven decline in prices has played havoc not only with the farmers. The record for commercial failures during the year as reported by Dun is an extremely bad one. The following table is of interest in this connection. The failures for each November during the past few years were as follows:

	No. of Failures	Liabilities of Failed Concerns
1918	570	$13,815,166
1919	551	9,177,321
1920	1,050	30,758,130
1921	1,988	53,469,839

For the eleven months of each of these years the figures were as follows:

	No. of Failures	Liabilities of Failed Concerns
1918	9,299	$150,770,496
1919	5,890	104,990,805
1920	7,356	236,250,260
1921	17,207	539,899,501

In spite of the difficulties through which we have been passing and in spite of the obstacles yet to be overcome, we are undoubtedly in a very much better position on the threshold of 1922 than we were at the beginning of 1921. We have endured the rigors of a serious industrial depression and while we cannot look for immediate restoration to great activity, nevertheless it seems probable that we have turned the corner and are on the way to betterment. However, before we can correctly interpret the signs along the way it is necessary to know the goal. We are seeking prosperity. It is essential therefore to know upon what foundations prosperity rests.

That the basis of prosperity is not correctly understood by the majority of persons has been shown by events of the past two or three years. Toward the close of 1919 and early in 1920, trained observers of business movements were forecasting the proximity of an industrial depression. These predictions were made in the midst of a period of extraordinary business activity. There was an insatiable demand for labor at the highest wages ever paid. Wage earners were spending these unprecedented incomes with a lavish hand. On all sides were persons who had made and who were still making huge profits from a great variety of industries—farming, manufacturing, selling, and speculating. In the face of these conditions there were observers who predicted that the end was near. On the contrary, many writers in the newspapers and financial journals, and most business men were very impatient with such pessimistic predictions. The outlook seemed rosy. A prominent financial journal said, "The year now beginning gives promise of being one of the most active industrially in the world's history."

Why So Many Misinterpret Conditions

It required only a few months to demonstrate conclusively which of these predictions was correct. What knowledge did the one group possess which the other group lacked or ignored? The facts were available to everyone; yet the great majority of persons accepted the erroneous point of view. How can this be explained? The answer is clear. The vast majority were deceived by surface conditions. Because business was active, labor fully employed, and retail selling going on in large volume, and because it was evident that the world needed large quantities of goods of all kinds, it was assumed that prosperity must necessarily result. There was well-nigh universal failure to look beneath the surface and to inquire upon what foundation prosperity really rests.

Prosperity may be said to stand on three legs—(1) a large and expanding scale of human wants; (2) productive capacity to satisfy the bulk of these wants; and (3) the provision of facilities and resources to maintain and improve the situation.

The visible evidence of a state of prosperity consists of the steady employment of the majority of employable workers, a noticeable improvement in the general standard of living, and the accumulation of capital in large quantity. It is extremely difficult to evaluate and measure prosperity in specific terms; and this difficulty is not made less troublesome by the fact that so far as surface appearances are concerned a period of activity preceding an industrial depression is nearly identical with a period of prosperity. There are, for example, in both periods great demands for laborers, great activity in retail buying, and considerable launching of new enterprises. This similarity explains why many people form an incorrect judgment of the economic situation.

How to Tell Bogus Prosperity

Although the two periods look alike, the difference between them is fundamental. In a community which is really prosperous, the physical volume of production is increasing, and a considerable portion of the output of industry is embodied in the form of capital goods —raw materials, machinery, buildings, etc.—used for the purpose of aiding production thereafter. In a period of bogus prosperity production is either falling off absolutely or is not increasing at a rate as rapid as should be expected. Furthermore the character of production differs. Output consists to a greater extent of consumers' goods than of producers' goods or capital.

The final test of prosperity is capacity for self-perpetuation. The question is, in which direction are we headed? In a period of real prosperity we are not only enjoying a rising standard of living but are building a firm foundation for the maintenance and improvement of that standard. In a period of false prosperity we are devoting our energies to the gratification of immediate wants with little regard for the future. This leads to an undermining of industrial morale which affects both employers and employees, and the ultimate result of which is a falling off in the total volume of production. Since prosperity depends upon an ample supply of want-satisfying goods, anything that causes a decrease in the output of such goods undermines prosperity. Is there any evidence that the bases of prosperity as here defined are being prepared?

While it is the opinion of the writer that real improvement has occurred in the business situation, the evidence of improvement is to be found in underlying financial conditions rather than in superficial commercial conditions. But this is as it should be; there can be no real improvement in commercial conditions—in retail sales, activity of manufacturing, in employment of labor—until financial conditions are sound.

Distinguishing Credit from Capital

The fundamental requirement for a solid financial structure is an ample supply of capital. Capital should be sharply distinguished from credit. Credit is merely the device by means of which capital is rendered transferrable from those who do not wish to use it themselves to those who do desire to use it. Capital consists of accumulations of material goods or wealth; credit consists merely of commercial and banking instruments which furnish a temporary claim to such wealth. Capital is accumulated only by production and saving; credit may be manufactured within

certain limits by the banks. These limits, while flexible to a degree, are fixed by the supply of real capital, and the credit advanced by the banks must ultimately be liquidated out of capital.

The confusion between these two is responsible for many of the unsound proposals advanced for restoring business activity. It is responsible also for the many bitter attacks which have been made during the past two years upon the Federal reserve system. We seem to feel the need for a "personal devil" in financial as well as in spiritual affairs. It is known that the Federal reserve banks have the power to provide credit in large volume. It is not so well known that it is the duty of these banks to maintain a proper relationship between the supply of credit and the supply of real capital. It was only when credit was being used beyond the point where a safe relationship was maintained between credit and capital that the Federal Reserve Board called a halt. That it was necessary to put on the brakes when they did can scarcely be doubted by any careful and unprejudiced observer. It is incredible that anyone can seriously believe that there would have been no depression if the Federal reserve system had not been in existence. The lack of balance between credit and capital was bound to bring on a depression under any circumstances, and it would have been very much more serious in the absence of a regulative body such as the Federal Reserve Board to exercise financial common sense.

The four sections of a business cycle:

PROSPERITY
DECLINE
DEPRESSION
RECOVERY

The greater part of 1921 was in the depression area.

Indications of last few weeks of 1921 point to reaching recovery.

Interest Rates as the Clue

Since financial conditions are more fundamental and more significant than commercial conditions and since the supply of capital is the most important of the financial factors, the interest rate for real capital—that is, the rate charged for the use of long-time funds, as distinguished from the rate charged for short-term loans, which are based largely upon the supply of credit—indicating the relation between the supply and demand, is the most significant single clue to the business trend.

There is ample evidence that capital is becoming available in larger amount. The following table indicates the change in the interest yield of a few selected bonds between the beginning and the end of the year.

	Yield, Per Cent— Mid-January, 1921	Mid-December, 1921
4th Liberty Loan 4¼s (1938)....	5.34	4.36
New York City 4¼s (1960).....	5.07	4.34
Dominion of Canada 5s (1931)....	6.52	5.13
United Kingdom 5½s (1937).....	7.01	5.79
Atchison general 4s (1995).....	5.16	4.68
Northern Pacific 4s (1997).....	5.16	4.72
American Tel. & Tel. col. 5s (1946)	6.46	5.40
Armour & Co. 1st 4½s (1939)....	6.48	5.20

These figures may be supplemented by other evidence. For example, new bond issues of states and municipalities for the first nine months of this year exceeded by about $250,000,000 the issues for the corresponding period of 1920, and far exceeded such issues for many years preceding. A large issue of Pennsylvania State bonds was sold during November at a net interest cost of approximately 4.35 per cent. The recent New York State issue of $55,000,000 was oversubscribed four times. Investment bankers in all parts of the country testify that their problem is not that of selling bonds, but rather of getting sufficient bonds to meet the requests of their customers.

Despite the depression, deposits in eleven savings banks in New York City are considerably higher now than they were at any time during 1920. Although the deposits in the postal savings banks have declined during the year, the December bulletin of the Postal Savings Department calls attention to a slight but steady increase in deposits in the smaller post-offices throughout the country. The chief losses in deposits have occurred in the large cities and industrial centers. In considering the status of savings deposits, account must be taken of the fact that a considerable part of the savings which have been withdrawn from banks and the postal department have gone into the purchase of bonds and other securities selling at bargain prices.

With the increase in the supply of capital and the resultant strengthening of the banking position, there has come an easing of the credit strain. Loans of the Federal reserve banks, which reached their highest level in October, 1920, had declined more than one-half by the close of 1921. About the beginning of January, 1921, the reserve ratio against notes and deposits in the Federal reserve system started upward from 44 per cent and progressed steadily, reaching nearly 73 per cent during the week ending Dec. 3. This increase in reserve ratio was brought about by an increase in gold reserves from $2,059,333,000 in the first week of January, 1921, to $2,849,397,000 in the first week of December; by a decrease in Federal reserve notes from $3,344,686,000 to $2,366,006,000; and by a decline in deposits from $1,846,093,000 to $1,728,497,000 during the same period. The discount rate in the reserve banks now averages about 5 per cent for all classes of paper, and in some of the Eastern districts a rate of 4 per cent is predicted for the near future.

Unsatisfactory Foreign Financial Situation

While domestic financial conditions are sound and are improving steadily, foreign financial affairs are still unsatisfactory. The committee appointed by the Chamber of Commerce of the United States to study economic conditions in Europe emphasized the fact that real recovery in the United States cannot be attained without great economic improvement in Europe. The committee enumerated as requisites for recovery in Europe, (1) appreciation of foreign exchanges; (2) growth of export trade; (3) reduction in governmental expenditures; and (4) strengthening of bank reserves.

As to the first of these, the present situation is unsatisfactory. The trend of practically all European exchanges has been downward since the Armistice—the general index for foreign exchange having declined from December, 1918, when it was slightly above par to September, 1921, when it was just a little above 50 per cent of par. This average was carried down mainly by the great decline in marks, although other monies declined heavily also. English exchange has shown improvement during the past year, being 71 points higher in the week ended Dec. 17 than it was during the first week in January. There has recently been a marked advance in sterling and slight improvement in French and German exchange. If this upward movement is maintained better financial conditions in Europe will be indicated. With improved financial conditions there will come increased demand for American commodities and a resulting stimulus to American business.

Healthy Trend in Foreign Exports and Banking

Recent reports on the trade of leading European nations call attention to the growth of their exports. Steady progress in exportation is being made by England, France and Germany. While the exports of none are equal to their pre-war exports the tendency is a healthy one.

Little advance has thus far been made by European

nations in reducing government expenditures. In the case of some nations the annual revenue of the government does not equal its expenditures. It is to be hoped that the Conference for Limitation of Armaments will reduce the danger of war and the need of war preparations so that government expenditures for all nations may be sharply curtailed.

As to the fourth requisite, there is evidence that the banking position is being strengthened in most countries. Germany and Russia are the outstanding exceptions to this improvement. The weakness in these countries is due to their reckless issues of inconvertible paper money. In Germany the quantity of paper marks has increased from 1,890,000,000 in 1914 to more than 86,000,000,000 at the end of September, 1921. The amount now probably exceeds 100,000,000,000 marks. Against these issues of notes there was held in the banks at latest report something over a billion marks in gold. This indicates a gold reserve against note issues of about 1 per cent—a reserve totally inadequate to maintain the value of the paper money.

Banking conditions in South and Central America and in Cuba, while still very unsatisfactory show improvement. In China, however, the banking situation is ominous. Runs on all the Chinese banks have been heavy, and the leading banks recently suspended payments to depositors and noteholders. A number of American banks have lost heavily through operations in various foreign countries and it is a noteworthy fact that a considerable proportion of the foreign branches established during the war and immediately following have been closed in some cases temporarily, but in many cases permanently. Financial conditions outside the United States are thus seen to be in general unsatisfactory but, except for a comparatively few localities, are improving.

Signs of Commercial Improvement

As was said earlier in this review improvement in commercial conditions is not thus far so clearly marked as in financial conditions. However there are a number of indications that the situation is mending and the improvement will soon be sufficiently noticeable to attract general attention. The number of business failures as recorded heretofore is curiously enough a hopeful sign, for it indicates that weak and inefficient businesses are being driven out of existence and that sound concerns can therefore make progress without being hampered by the existence of unsound competitors. Failures always become very frequent and the total of liabilities becomes very large toward the close of a period of depression. While the number of failures is likely to be large for some months to come, the tendency will undoubtedly be toward fewer collapses.

Rapidly declining prices have had an unsettling effect upon the market and have hampered production, but it is now possible to note improvement in this respect. Within the past few months greater stability has been shown in prices both in the United States and in Great Britain. This enables purchasers to stock up with goods in larger volume since there is less danger now of decline in price. This is only a temporary phase, however, for the prices of many commodities are certain to work lower. Unemployment which has been very serious is, according to reports of the Department of Commerce, decreasing. During October, 44 out of 65 selected cities showed a net increase of persons employed of 1.01 per cent over September.

Reports from the retail trade also indicate improvement. While the total value of sales in dollars is smaller than last year because of price decline, the actual amount of goods sold has apparently held up fairly well and has recently shown a tendency to increase. Sears-Roebuck sales gained 17.3 per cent in October over September. Montgomery Ward & Co. showed a 21 per cent gain. The sales from Woolworth stores during the first ten months exceeded those of 1920 by 3.18 per cent, while the sales of the Kresge Co. exceeded 1920 by 8.6 per cent. Reports collected by the Federal Reserve Board from 372 department stores showed a decline in value of sales of 6.2 per cent in October, 1921, as compared with October, 1920, but this figure for October shows an improvement over the September business; and in volume of sales October, 1921, exceeded October, 1920, by nearly 20 per cent.

Construction Activity in 1922

The best prospect for improvement is found in the tremendous amount of construction in all lines, which only awaits a favorable opportunity to begin. It has been estimated by Walker D. Hines, formerly director general of railroads, that the railroads must spend more than a billion dollars a year for some years to come if the transportation facilities are to be kept equal to our needs. The great demand for tax-free municipal securities has stimulated the issue of such bonds to an unprecedented extent. Hence states, cities, and minor civil divisions have obtained funds with which they are planning to carry on public works, such as road construction, erection of public buildings, and similar projects. This will create a demand for structural materials and labor, which added to the private demand for housing and investment property will work considerable improvement in conditions during 1922. Architects in the various cities of the country agree that plans and estimates in their hands for the construction of dwellings and other properties in the near future will give a considerable stimulus to business. Building material dealers report large inquiries for building projects to be undertaken in the spring.

The movement toward increased construction made headway even during 1921. Despite the decline in prices as compared with 1920, the figures for new building in October, 1921, were 25 per cent greater than for October, 1920. The value of construction during the first ten months of 1921 was nearly equal to all of the construction for the whole year of 1920. The increase in the supply of capital has made funds available also for corporations. This will undoubtedly stimulate construction work by railroads and other public utilities. From all these points of view, therefore, it seems reasonable to expect that 1922 will show a tremendous increase in construction activity. This will in turn be reflected in improvement in all other lines of industrial activity.

Importance of Disarmament Conference

Finally, attention should be called to the possible betterment which would be inaugurated by a successful termination of the Disarmament Conference. It has been estimated that the head of every family of five in the United States is paying nearly $100 per year in taxes solely for war debts and in preparation for future wars. The people of other nations are hit even harder. While a cut of $200,000,000 in American naval expenditures would of itself have only a slight effect on the individual's tax bill, a corresponding reduction by England and Japan, to say nothing of the reduction in military expenditures by all the nations of the world, which may result from the conference, will have a tremendous influence in setting free large sums of capital now devoted to war preparation for use in private commercial enterprises.

There is universal complaint in this country that heavy taxation is hampering business revival. The obvious place to begin reduction in taxes is in the war budget. It has been estimated that the cost of maintaining the Navy Department, the War Depart-

ment, the Veteran's Bureau, paying pensions, and meeting interest on the public debt, will for 1923 be a little less than three billion dollars or 83 per cent of the total national budget. Any plan which makes possible the reduction of these expenditures immediately and which looks toward still greater reductions in the future cannot help but have a remarkably stimulating effect upon economic activity. A favorable outcome of the conference may be counted on to hasten business revival.

Enameling Cast Iron and Steel Materials

Methods and Apparatus Used—Care Needed in Preparing Surfaces for Treatment—Burning on the Enamel

BY F. L. PRENTISS

ONE of the indirect results of the World War was the development in this country of the manufacture of cast iron enameled apparatus with high acid-resisting qualities, for use particularly in the chemical and pharmaceutical industries. Equipment of this type, formerly largely imported from France and Germany, is now being made by several American manufacturers. Cast iron enamel lined products used in these two industries include such equipment as shallow dishes for evaporating purposes, open and closed top kettles, both jacketed and unjacketed, stills for vacuum and pressure work, digesters and condensers, equipment used primarily in industries where the various processes cannot be carried on in contact with metal containers.

Trimming, with a Bevel Shear, the Plate from Which a Tank Is to Be Made

One of the pioneers in this industry is the Elyria Enameled Products Co., Elyria, Ohio, which established a plant several years ago under the name of the Enameled Pipe & Engineering Co. to enamel pipe used in mining and other industries requiring pipe with an acid resisting coating. Later the company, under its present name, turned its attention to the manufacture of various lines of enameled steel equipment used in the dairy industry, including ice cream making processes, in the manufacture of edible foods and oils in the preparation of canned foods, and apparatus used in the chemical and pharmaceutical industries. The demand for enameled lined steel equipment has grown rapidly the past few years, particularly from the milk handling industry. The company added a cast iron enameled ware department during the war time period.

In general, the steel apparatus is provided in much larger units than the cast iron utensils, and is used in such fields as the dairy industry, which does not require containers with the higher acid resisting qualities necessary for the more severe chemical conditions met in the chemical industries. Consequently, the cast iron apparatus is enameled with an entirely different formula from that used in enameling steel equipment.

Enamels prepared according to two formulas are used for steel, one for the dairy industries and the other for ware calling for more severe organic acid-resisting qualities. Cast iron enameled ware is being produced with high acid-resisting enamel, for use with mineral acids; but it is stated that the application of this mineral-acid-resisting enamel on steel is not practical.

The plant of the Elyria Enameled Products Co. has two separate manufacturing departments for the two lines of products. In addition, there is an assembly department where the finished parts are put together after the necessary machine operations. The shop in which the steel apparatus is fabricated, known as the tank shop,, is equipped with two 5-ton electric traveling cranes. The assembly department has a 7½-ton crane operated on a runway 36 ft. above the floor, and providing sufficient head room for assembling jackets on large tanks.

Enameled steel equipment is made of basic open-hearth steel, complying with boiler steel specifications, but not running over 0.15 per cent. in carbon, as difficulty is found in enameling steel higher in carbon, for blisters are likely to occur in the enameling. Various pressed steel shapes of thickness lighter than ¼ in. are fabricated outside the plant. Most lighter stock ranges from 16 to 24 gage.

For apparatus made in the shop, ¼ in., 5/16 in. and ⅜ in. stock is used. The apparatus consists generally of cylindrical units with closed or open tops, and with various openings. After the stock is sheared, a cylinder is formed to the desired diameter on a Cleveland bending roll with a capacity for stock 1 in. thick and 13 ft. long. The longitudinal seam in the tank is made by oxy-acetylene welding; and the bottom, as well as the top, if it is a closed tank, is similarly welded on. Arc welding is used to a certain extent. The plant has 24 gas welding stations each using a No. 8 oxy-acetylene welding torch.

Seamless steel enameled tanks are made as large as 132 in. long and 120 in. in diameter, tanks of this size being used with apparatus made for the manufacture of condensed milk. In making the tanks, it is necessary that the surface to be enameled be smooth and clean. After the tank is assembled and the necessary openings are provided, the welds are ground down with portable electric grinders, and then the entire surface is sand blasted. Gas pockets and laminations in the steel, certain types of segregations and dirt on the surface, are the principal sources of trouble in enameling, resulting in blisters. Small imperfections found during enameling can be covered with additional coats of enamel, but it is impractical to try to cover up serious defects. Instead, all the enamel already on is sand blasted off and the piece is re-enameled. Sand blasting large units

Shaping the Plate to Its Cylindrical Form on a Bending Roll

requires one of the largest sand blast equipments ever built. This consists of four adjoining sand blast rooms, 15 ft. high and 20 ft. deep; two are 15 ft. wide and two 10 ft. wide. The sand blast plant, which was designed to meet special requirements, was supplied by the J. W. Paxson Co.

After sand blasting, the tanks are ready for the

Welding the Seam on a Large Tank

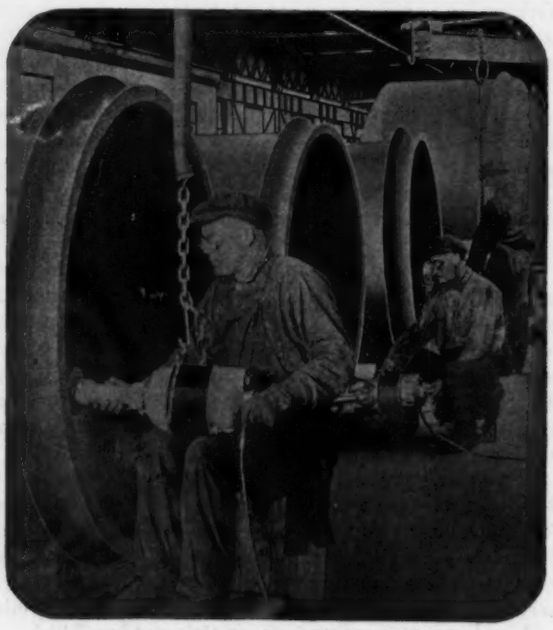
enamel, which is applied to the surface in various ways. In plants making kitchen ware, the ware is dipped in enamel, but as this ware is not made in the Elyria plant, the dipping process is not followed. In enameling long pipe, the pieces are placed in an inclined position and the enamel is poured through while the pipe is rotated.

Enamel is applied to steel apparatus of large dimensions by the spraying process, by means of deVilbiss & Paasche air atomizers. In enameling a large closed top tank the operator of the spraying device works from the inside, getting into the tank through a manhole. Usually about four coats of enamel are applied, each coat being burned on in a furnace after it is dried.

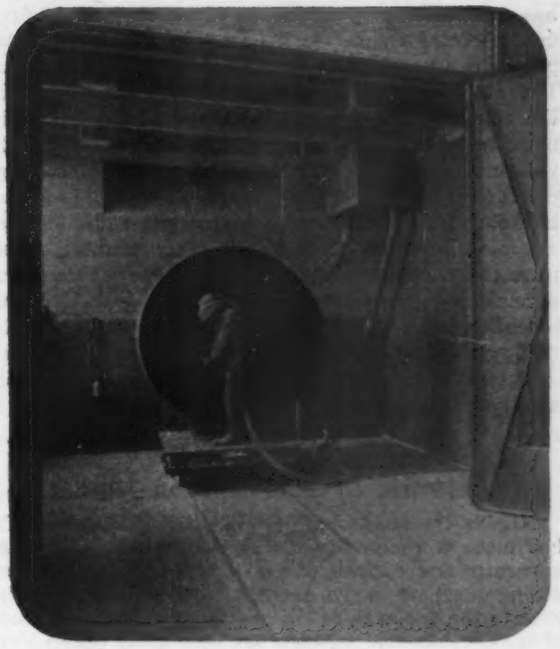
Portable blowers circulating a cold blast are used for drying the enamel, but the use of mechanical drying equipment is usually confined to drying the interiors of units with closed tops. The drying equipment consists of small portable Buffalo Forge Co. blowers placed on pipe frame racks about 4 ft. high, mounted on casters. A movable table, that is raised and lowered by means of a cable and wheel above the rack, provides a base for the blower, which permits setting the blower at the proper elevation to discharge into the opening in the tank, standing on the shop floor.

For burning the enamel, direct fire furnaces are used, the practice differing from that followed by makers of enameled kitchen ware, who generally use furnaces of a muffle type. Three furnaces are installed, one with doors 6 ft. square, one with doors 9 ft. square and a third with doors 14 ft. square, the largest furnace being 18 ft. deep.

The two larger furnaces are designed for firing with gas or fuel oil, but the latter is now used, the oil being vaporized in the burner. The small furnace is gas fired. The furnaces have double doors, which are hydraulically operated, their operation being similar to doors of open-hearth furnaces. Blast for the two large furnaces is supplied by General Electric centrifugal blowers - 3-lb. pressure, the larger supplying 3800 cu. ft. of



Grinding Off the Burr After Welding



Sand-Blasting a Tank in One of the Sand-Blast Rooms, Prior to Enameling

free air per minute, and the smaller 2500 cu. ft. The furnace equipment was supplied by the General Combustion Co.; furnace temperatures are taken with Brown recording pyrometers.

The two larger furnaces are charged with special Morgan type charging machines, having all the movements of a standard open-hearth charging machine, except the circular and turning over movement of the charger. These machines are electrically operated from a pulpit. In operation, a special burning rack is preheated, and then withdrawn from the furnace on the charger and the piece placed upon it. The furnace temperature for burning ranges from 1800 to 2000 deg. F., depending on the size of the piece. After the final coat of enamel is fired, the part goes to the assembly department.

Methods followed in the enameling of cast iron differ somewhat from those used in enameling steel. The utensils made in the cast iron enameling department are mostly kettles and stills, which are made up to sizes requiring castings 1500 lb. in weight. These utensils are made of special iron of a dense structure.

The castings, on going from the foundry, are first ground, then pickled, and then burned out in a furnace; then, after sand blasting, they are ready for enameling. The enamel is burned on cast iron in two coal-fired, muffle type furnaces. Two charging machines are provided for charging these furnaces, one electrically operated and one hand operated.

In enameling a cast iron shape, a ground coat is applied with spraying apparatus. After drying, the work goes to the furnace, and is brought close to a bright red heat. From this point the enameling process departs from that in enameling steel. Instead of spraying liquid enamel on after the part has become cool, as in the case of steel, the enamel is applied in the form of fine dry powder, which is sprinkled on the part while hot

Spraying Enamel Upon the Inside of a Tank

by means of a device known as a "dredge," which consists of a sieve and air-operated vibrator.

During the enameling operation the part rests on a turntable in front of the furnace. By means of the turntable the ware is rotated, tipped to any angle, or, if desired, turned completely over, so that all parts to be enameled can be reached. The turntable is equipped with two motors, one for revolving in a horizontal plane

Method of Charging a Tank into the Burning Furnace After Enameling; the Charging Machine Is Similar to an Open-Hearth Charging Machine

Applying Dry Powder Enamel to a Hot Cast Iron Tank Head After the First Coat of Enamel Has Been Burned On. The piece is handled on a power-operated turntable by which it can be turned to any position so that the enamel can be applied to the entire surface

and the other for raising it on its vertical axis. Other movements are accomplished with compressed air. Beneath the turntable is a hydraulic plunger, which, after the enamel is applied, raises the piece up to a point where it can be picked up by the charging machine and again placed in the furnace.

The operations of burning and enameling continue until the desired thickness of enamel is produced. The work is kept in the furnace from 10 to 30 min., or long enough to bring it to a sufficient temperature to fuse the enamel down to a fairly uniform coat. After the final coat the work is given a longer firing than for the other coats, and the finished part comes from the furnace with a smooth surface and high gloss. All enameling of both steel and cast iron is done in blue, although any other color could be used by mixing the desired pigment into the enamel.

The plant has well quipped laboratories, the laboratory organization including ceramic engineering, chemical engineering, metallurgical engineering and analytical departments. The ceramic engineering department has supervision over the preparation as well as the processing of the enamel in the factory, and specifies the proper enamel to be used to meet certain conditions. The chemical engineering department functions with the sales department in specifying the proper equipment to meet conditions of a given inquiry, and in developing new uses for enameled ware. The metallurgical department deals with the metallurgical problems, including selection of steel, cast iron, etc. Adjoining the ceramic laboratory is a furnace room, containing a complete experimental enameling plant. The laboratory of pyrometric equipment consists of a Leeds & Northrup potentiometer and optical pyrometer, a Thwing radiation pyrometer and a Brown portable pyrometer. This equipment is used in checking factory pyrometer equipment, as well as in experimental work.

Electric Developments in 1921

Under the above heading the General Electric Co. has made a comprehensive report of new designs of apparatus and methods of use of apparatus brought out during the past twelve months, with particular reference to the products of that company. The great bulk of the development reported has been along purely electrical lines, and largely for power plant use. Many improvements are reported, however, in motors and motor control for industrial use.

In electric arc furnaces, two new brass furnaces have been brought out during the year, one of 1500-lb. capacity and the other of 50-lb. Both are worked on the muffled arc principle, and either will melt practically any metal requiring a pouring temperature not exceeding 2370 deg. Fahr.

Particularly adapted for use in the larger non-ferrous metal foundries, the 1500-lb. unit is for three-phase operation, with a power consumption of not over 270 kwhr. per ton. The power factor is 95 per cent or better, and the metal losses are reported very low, being less than 1½ per cent for yellow brass and less than ¾ per cent for red brass. The 50-lb. unit should find a large field in small jobbing foundries, manufacturing plants, laboratories, etc. Its main characteristics are the same as for the larger furnace, except that it is single phase, and its power consumption is from 35 to 40 kwhr. per 100 lbs.

The National Association of Building Trades Employers will hold its annual convention Jan. 12, 13 and 14 in Cleveland.

Steel Tanks Under Hydraulic Test After Partial or Complete Assembly

The Operation of Basic Electric Furnaces

How to Avoid Delays in Each of the Eight Major Operations of Making Steel in Furnaces Having Movable Electrodes

BY M. W. CARUTHERS*

IN the operation of an electric arc furnace for the manufacture of steel, delays occur which are of much the same general character as those encountered in the open-hearth and Bessemer process, although differing where different methods are required for their manipulation. There are two kinds of delays: Avoidable, or those within the control of the manufacturer, and the unavoidable delays, or those of which the steel maker has no control, such as interrupted power service, crane breakdowns and numerous others of which no further mention is necessary. Both kinds of delays are an absolute loss to the steel maker in that they are enemies of production and will be treated as such in this paper.

The avoidable delays may be classified as those occurring in the eight major operations of an electric arc furnace: Charging, melting-down, slag formation, refining, decarbonizing, recarburizing, addition of ferro-alloys and breakage of electrodes.

Charging

There are two types of electric furnaces, with reference to charging, which are being used for steel making. One type has a stationary roof and the charge is thrown in through the doors on the sides of the furnace, while the other type is so designed that the roof can be raised to allow the charge to be placed in the furnace by an overhead crane.

The majority of the stationary roof type furnaces are charged by hand because the door openings are not large enough to permit a charging box of an economical size to be used by a charging machine. A review of the melt sheets will show that many minutes are consumed in hand charging that could be utilized for melting down if mechanical charging were possible or if a raisable roof type furnace were used. As mentioned above, the raisable roof type furnace is well adapted for crane charging and the time consumed in charging will be cut to a minimum providing sufficient crane service is available to take care of the pouring of the heat and the handling of the charging boxes without delaying the execution of either. The charging boxes should have collapsible bottoms so that they could be operated on somewhat the same principle as a clam-shell bucket and they could then be lowered into the furnace and the charge released with the least possible time-loss and damage to the furnace lining and bottom.

However, it is possible to remove the roof from a stationary roof type furnace, which is the one in most common use, but this requires a crane, which means that the roof must be lowered to the floor to liberate the crane so that it can pick up the charging boxes. This constant handling of the roof would shorten its life considerably, and, no doubt, would counteract the advantage to be gained by roof charging. Assuming then that hand charging through the doors is the method most commonly used, a system with regard to charging of the scrap should be followed that will bring the most efficient melting down conditions. The importance of systematic charging can be easily determined by noting the shorter period of time required for melting down under this condition.

Heavy Scrap First

Heavy scrap, such as scrap ingots, crop ends, butts, cogging scrap, heavy gates and risers should be charged first on the bottom of the furnace and as nearly in the path of the electrodes as possible. This arrangement will retard the movement of the electrodes down through the charge until enough scrap has been melted to form a pool of molten metal on the bottom. Ladle skulls should be charged next, care being taken that they are not exposed where the electrodes will touch them when the charge is all in the furnace, for in most cases they are poor conductors, due to uneven surfaces and adhering refractory materials. The lightest scrap should be charged last and should be thrown into the furnace so that the center is kept full. If this precaution is not taken it will be impossible, at times, to get all of the charge in at one time and further charging will be necessary. Considerable time is usually lost with the additional charging operation, and the above-mentioned process, if followed, will be found to be advantageous. If there is any great amount of light scrap, difficulty will sometimes be encountered in getting a good contact, which may be overcome by placing a piece of heavy melting scrap directly under each electrode.

Care of the Bottom

It will be appropriate to mention a few rules that should be followed in the care of the bottom of the furnace. Attend to any bottom trouble promptly after the heat has been tapped while the steel in the hole is still in the molten state.

When the furnace bottom is in good order, drain it as free as possible from molten steel before charging. If there is molten steel pocketed that will not drain out, mix it thoroughly with refractory material such as dolomite, magnesite, or any of the preparations that have been found to be satisfactory for bottom repairs, by means of a rabble bar, and pull as much of the conglomerate mass out of the furnace as can be pulled out. This measure of precaution will be rewarded by fewer shut downs, necessitated by the burning in of a new bottom or the cintering in of a patch in the old one.

Melting Down

Delays in melting down can be partly eliminated if the furnace operators do not start to "push-down" until there is sufficient molten metal in the bath to envelope any remaining unmelted scrap that is pushed in. Most furnace helpers are anxious to have the heat melted as quickly as possible, especially when they are being paid on the tonnage basis and they think that, by pushing down as early as they can, they are speeding up the tapping of the heat. The reverse of this is true, for if there is not enough molten metal in the bath, the unmelted scrap will "freeze" the surface of the steel that has melted. This not only means that

*Engineer Westinghouse Electric & Mfg. Co., Pittsburgh.

more time is consumed in getting the bath molten again, but also that the refining of the heat will be delayed.

Excessive Power Demand

The power demand of an electric furnace is always greater at the melting down period than at any other time during the heat, and if the electrodes are allowed to surge with long reactionary rebounds, the greatest demand on power is being established. Hand control, for a period of from 10 to 15 min. after "power-on" has been used as a precaution against the conditions causing a peak load, but this experiment is not the solution, as the personal equation is the most important factor to be considered, and if the furnace operator has been working a heat for an hour and a half or two hours at 4 or 5 o'clock on a summer morning, it is the natural temptation to "throw it on" automatic control and go outside to get "cooled off." A peak may be established before the operator comes back to the furnace again, and that little rest which the furnaceman is really entitled to may cost his employer considerably more than it was worth to either.

An electrical device is being installed on furnaces now that greatly lessens the danger of excessive power demands being established. This equipment, known as the automatic current regulator for electric arc furnaces with movable electrodes eliminates "hunting" by shortening the distance through which the electrodes travel, thus furnishing a more constant power and resulting in a shorter period for melting down.

Slag Formation

The selection of melting scrap, used even for the making of real high quality steel in the electric furnace, can be so carried out that it is unnecessary to slag off at any time during the heat. It should be remembered, though, that scrap containing alloys should not be stocked with straight carbon scrap unless the alloy is of such a character and of such a small quantity that it will be lost by oxidation during the melting of the heat.

A good oxidizing slag which, when it has served its purpose, may be changed over to a reducing slag by the addition of lime, fluorspar and coke breeze, may be made by adding about 120 lb. of lime to the charge when it has been melting down for 15 min. This amount is based on a 6-ton charge. Other quantities for other size charges should be used in proportion.

The oxidizing or first slag has thus had an opportunity to partially do its work before the heat has been entirely melted and the addition of a small quantity of fluorspar will very often thin the slag sufficiently to make it thoroughly efficient. Although the constituents of the oxidizing or black slag are fairly stable, they can be changed to form the reducing or white slag by the addition of lime, coke breeze and fluorspar in the proportions of 11, 4 and 5 in the order mentioned. These are standard amounts for a 6-ton charge and, although additional quantities may be necessary to form and hold a good reducing slag for a predetermined period of time according to the nature of the heat, they will be found reliable in most cases.

Refining

The stirring of the heat while under the reducing slag may be carried to excess if the necessary care is not taken to avoid the mixing of the slag and the steel. It should be remembered that a slag is formed on a heat of steel for the purpose of refining the steel by its absorption of gases and impurities in the bath, but if the stirring is too violent or performed too often, small particles of slag are liable to be forced into the bath and entrapped, thereby losing their usefulness on the surface of the bath and also resulting in slag enclosures in the finished product.

Stirring of the steel should be confined to gentle agitation of the bath so that small pockets of gases will unite and minute particles of slag and other impurities will combine. This increase in the volume of both causes them to be forced to the surface. Stirring of the slag should be a replacement or turning-over process, so carried out that a fresh surface contact of an oxidizing or reducing nature will be kept on the bath until refinement of the steel has taken place.

It has been generally conceded that a heat of first quality steel should be kept under the reducing slag for at least an hour, but this time limit is controlled by different melting conditions. Steel containing alloys of high segregating powers should be kept under the reducing slag for a sufficient length of time to insure a homogeneous mixture in the bath. A preliminary check analysis of the alloys in question will satisfy the operator when this condition exists.

Decarbonizing

Decarbonizing of a heat of high quality steel by an oxide of iron is injurious to the steel, even when carried on under ideal melting conditions. There are times, however, when existing conditions demand a quick reduction of carbon in order to save a heat, and in such cases it may be treated with iron ore, mill scale, cinder, or some other oxidizing agent, to get the desired carbon content, although the heat thus treated should not be considered a first quality heat of steel, and an analysis of the finished product will show that the oxygen, hydrogen and nitrogen contents are higher than if other means of reducing the carbon had been used.

Decarburizing a heat of electric furnace steel should be brought about by the use of a low carbon steel, melting (muck) bar, Swedish iron or Norway iron. Its addition to the heat will, in no way, lessen the quality of the steel unless highly oxidized material is used, and the time consumed by this method, to get the desired carbon content, is considerably shorter than by the oreing-down process.

Furnace capacity should not be overlooked when considerating the use of scrap, however, as it takes considerably more scrap than an oxidizing agent to reduce a heat the same number of points of carbon. The evolving gases, when an oxide has been used, have a scouring effect on the side walls and roof of the furnace, and the adoption of this practice for decarbonizing will shorten the life of the refractories considerably.

Recarburizing

Little can be said of the means of saving time in the recarburizing of a heat, as most methods commonly used are fairly efficient, although some have advantages over others.

The use of pig iron, or preferably washed metal, is considered the most desirable way of raising the carbon when the capacity of the furnace will permit, since it has two advantages: The carbon is raised to the desired point or limit and the tonnage is increased by the metal addition. This method is more expensive from a raw material standpoint and for that reason the introduction of carbon in some other form is very often used and found reasonably satisfactory, especially when the charge is too high in the furnace to allow of any additional metal. Coke breeze is often used by shoveling it into the furnace and beating it into the bath, but the uncertainty of the results to be obtained from it causes the furnace operator to hesitate using it, when he desires to raise the carbon more than 0.20 to 0.25 per cent.

Use of Old Electrode Couplings

The use of scrap electrode couplings has been found to produce very good results. They may be thrown into the bath and allowed to float around until the

operator, by actual experience, thinks that sufficient carbon has been absorbed by the bath. They may be used over and over again and their use is recommended in many cases, as the couplings are of very little commercial value as scrap and their use in this way can be considered as a double saving.

The lowering of the electrodes into the bath is a practice also being used very widely to introduce carbon into a heat, but the amounts of carbon obtained vary so widely with different heats that the practice should be used with precaution. It has been the writer's experience to have as much carbon absorbed from the electrodes in 10 min. by one heat as was absorbed in 55 min. by another heat, the electrodes extending the same distance into the bath in each heat and both heats were under a white slag the same length of time.

Addition of Ferroalloys

The factors to be considered in the addition of ferroalloys are the time and manner of their addition by which maximum efficiency will be obtained.

Nickel should be added to any charge as soon as the heat is entirely melted, as its stableness is so pronounced that no loss will be experienced from oxidation and ample time will be given for its dissemination.

Ferrosilicon, being the least expensive of the commonly used alloys, may be added to the heat as soon as the white slag has been formed. It has been found good practice to divide the amount to be added into two equal parts when the desired silicon content in the finished product is to be 0.55 per cent or less, adding one part after the white slag has been formed and the other about 10 min. before tapping time. When the desired silicon content is to be greater than 0.55 per cent the division of the ferrosilicon should be so proportioned that the greater amount is added first, the amount increasing in proportion with an increase in the desired silicon content in the finished product.

Introducing Chromium and Vanadium

Ferrochromium, although not as free from oxidation as nickel, is fairly stable, and its addition in quantities up to 200 lb. for a 6-ton charge is considered safe in most cases when the heat has been under a white "falling" slag for half an hour. It may be added earlier if the finished product is to finish over 2 per cent chromium. The addition of a great quantity of finely divided chromium should be avoided, as some of it will be taken up by the slag and, if not detected by the usual green tint of a slag containing chromium, will not be recovered.

Ferromanganese oxidizes slowly and may be added in appreciable quantities as soon as a good white slag has been formed.

Ferrovanadium, a very active alloy, should be added from 15 to 20 min. before tapping, and to get the greatest efficiency from its use it should be inclosed in a perishable metal container of some sort and forced down into the center of the bath. This can be done by wiring the receptacle to the end of a stirring rod and forcing it down into the bath quickly. A heat should be under a white slag for at least 45 min. before adding ferrovanadium.

The same practice should be followed in adding ferrotungsten to a heat of steel as is used in adding ferrovanadium, with the exception that ferrotungsten can be added from 5 to 10 min. earlier than ferrovanadium on account of their relative activities.

Breakage of Electrodes

Electrode breakage, like the improper addition of ferroalloys, is a double loss to the steel manufacturer. The broken electrodes are of small monetary scrap value, and production is held up while new electrodes are being put into place. There are electrode breakages, of course, which are unavoidable, but if proper care is exercised when new electrodes are put into place the number of these delays will be greatly reduced. When an electrode is put into place it should be tightened until the efforts of two men will not cause it to tighten down any further. This is important for two reasons: First, if an electrode is not screwed down tightly, it will form an escape for electric current and cause a "hot-spot" to form, and second, the hot-spot will weaken the joint sufficiently to reduce its resistance to shock to such an extent that breakage will occur at that point. The joint compound used when placing a new electrode into place should be plastic enough to fill the obvious crevices and firm enough to prevent its being forced out of the joint when the electrodes are tightened together and the amount used on each joint should not exceed from 5 to 10 lb. for a 17-in. electrode, with an amount varying in proportion for other sizes of electrodes.

Another cause for electrode breakage is when the surging of the electrodes causes them to work out of alignment. This happens when the cast shoulder, fitting around the bus-bar, is jarred around on the bus-bar enough to shift the electrode out of plumb and in striking a cold charge, particularly of heavy stock, it hits a glancing blow which will weaken the electrode and in time will break it off. Breakages resulting from this cause happen as a rule only during the melting down period, and will rarely occur if a reasonably light melting scrap is used, but will happen fairly regularly when the charge is made up of mostly heavy scrap.

General Remarks

The excessive demands made on the electric furnace, until a short time ago, caused by erroneous information having been circulated by furnace salesmen, make it all the more important that each operation of the furnace be studied thoroughly with the point in view of obtaining standard operating data. Such information will help to place the electric furnace on the firm basis that it should be and will help to dispel the thoughts that are injurious to the industry from the minds of those not using electric furnaces at this time, but who may consider their purchase in the future.

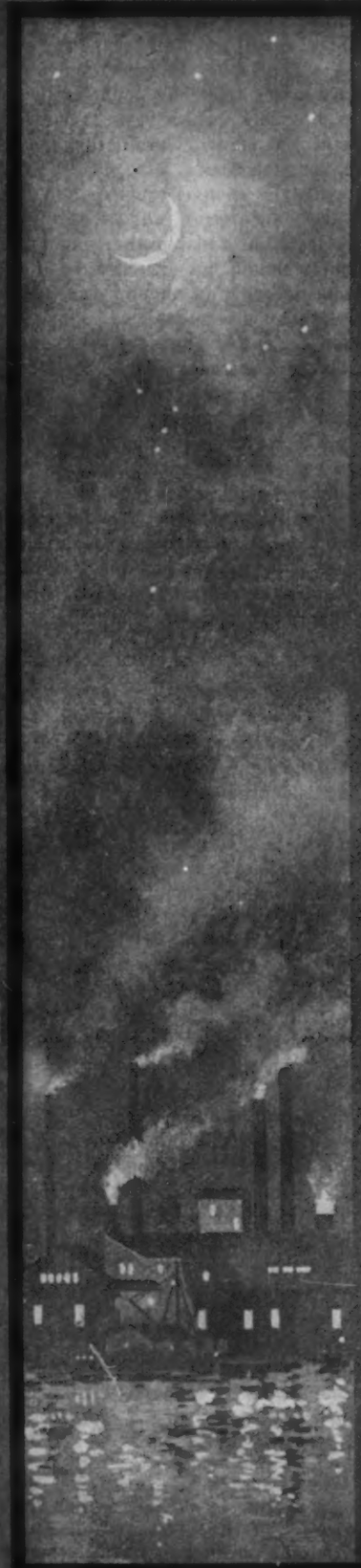
The electric furnace, although not fulfilling all the requirements that were expected of it at first, compares favorably with other melting mediums used for the making of steel. It is now being used to produce all kinds of steel, and is rapidly coming into prominence for use in the foundry and for the making of high-grade tool steels. It is well adapted for melting of small amounts of ferroalloys and the recent installation of two furnaces of 35 tons capacity is proof that the tonnage from electric furnaces will steadily increase. This will be especially true if the power rates on electric current are reduced, with a consequent lowering of operating costs, since the kilowatt hours per ton of steel produced are reduced as the furnace capacity is increased.

It is reasonable to believe that, with the impending scarcity of natural gas and the increased rates for the now limited supply of same, the electric furnace will make more rapid strides to the front than it has made so far.

The War Department is to use the standards adopted by the American Engineering Standards Committee by order of the Secretary of War, who directs that the supply branches utilize the specifications through a technical committee which now exists.

A. H. P. Leuf, receiver for the General Utilities Co., 1326-30 Ogden Street, Philadelphia, has arranged for the sale of the property of the company, including machine tools and other equipment.

· EMPOWERED · I · DRIVE · TRAFFIC



I · AM · TITAN ·

· I · am · Steel ·

· · · Buried · I · lie · until · called · to · be · servant · to · man. · · · Borne · to · a · city · of · industry, · fires · make · me · flow · into · many · forms · and · busy · shops · transform · me · for · a · world · of · work. · · · I · am · cast, · rolled, · cut · into · a · myriad · tools · and · devices, · each · gifted · with the · soul · of · a · craft. · · ·

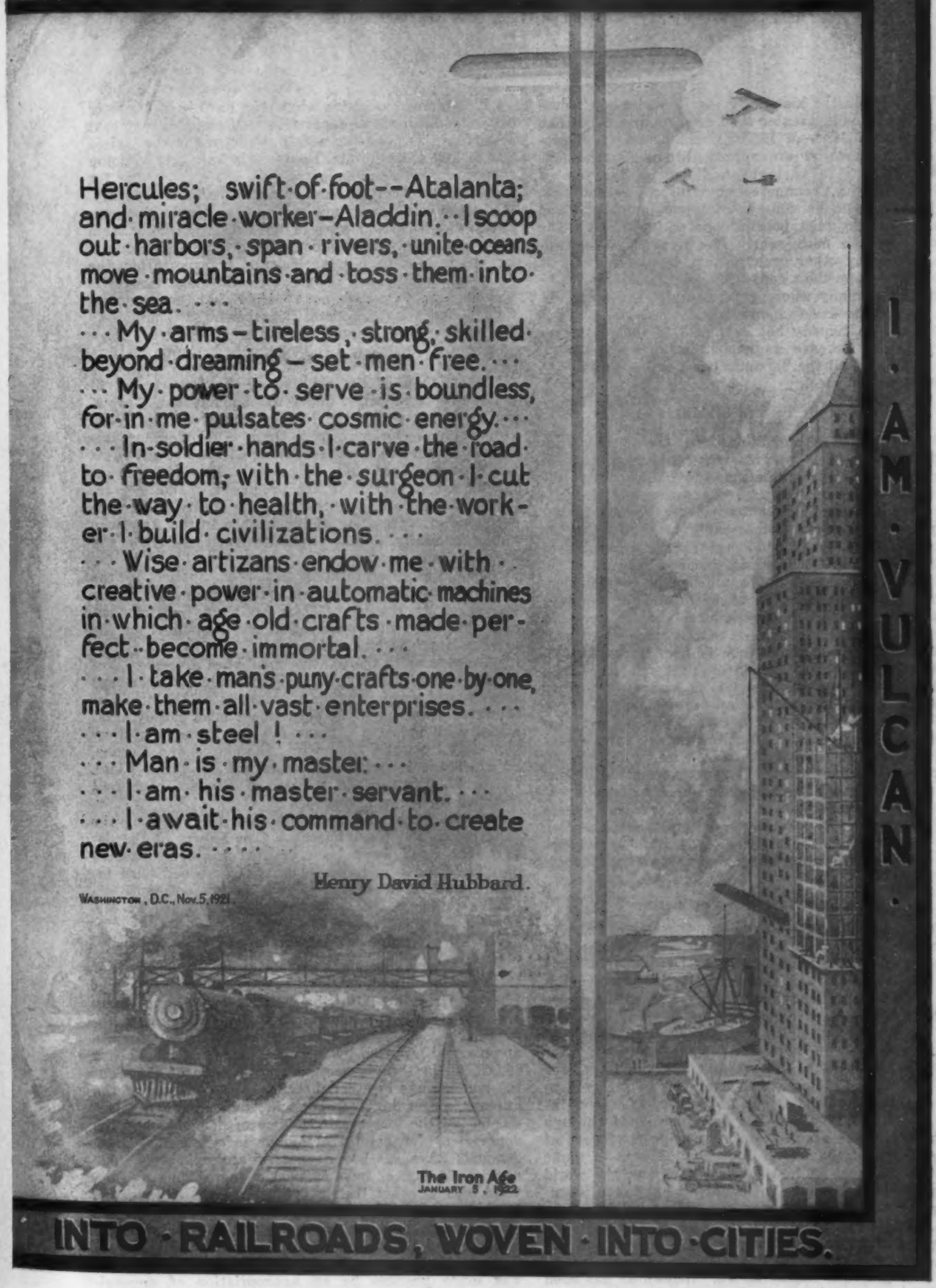
· · · As · forge, · with · heart · of · fire, · I · defy · cold, · melt, · transmute, · refine. · · I · am Vulcan. · · As · motor, · alive · with · breath of · flame, · I · give · natures · force · to · man. I · am · Titan. · · · Empowered · I · drive · traffic · over · land, · sea, · and · air, · turn · the wheels · of · industry · in · field, · mine, · and factory. · · ·

· · · My · tools · cut · vast · timbers · into · useful · shapes, · bind · structures · to · shelter · mankind. · · · With · me · men · plow · and · plant, · garner · and · grind · to · feed · a · race, · and · women · cut · and · sew · to · clothe · the · world. · · · As · magnet · I · guide commerce · on · trackless · seas. · · I · become pen · and · press -- through · me · man's · thoughts · pass · to · the world · and · posterity. · · · I · am · hammer · and · anvil · of · the · race, and · forgings. · · · I · arm · states · with · ship, tank · and · gun; · raze · far · cities, · over · turn · dynasties, bring · new · eras. · · I · become · bridge, · train, · vessel, · skyscraper. · · I · am · forged · into · factories, · spun · into · railroads, · woven · into · cities. · · ·

· · · I · make · man · strong · of · arm, -- -

· I · AM · FORGED · INTO · FACTORIES . SPUN

OVER · LAND , SEA · AND · AIR ·



Hercules; swift·of·foot--Atalanta; and·miracle·worker–Aladdin.··I scoop out·harbors,·span·rivers,·unite·oceans, move·mountains·and·toss·them·into· the·sea.···
···My·arms–tireless,·strong,·skilled· beyond·dreaming–set·men·free.···
···My·power·to·serve·is·boundless, for·in·me·pulsates·cosmic·energy.···
···In·soldier·hands·I·carve·the·road· to·freedom;·with·the·surgeon·I·cut the·way·to·health,·with·the·work- er·I·build·civilizations.···
···Wise·artizans·endow·me·with· creative·power·in·automatic·machines in·which·age·old·crafts·made·per- fect--become·immortal.···
···I·take·man's·puny·crafts·one·by·one, make·them·all·vast·enterprises.···
···I·am·steel !···
···Man·is·my·master:···
···I·am·his·master·servant.···
···I·await·his·command·to·create new·eras.····

Henry David Hubbard.

WASHINGTON , D.C., Nov. 5, 1921.

I·AM·VULCAN·

The Iron Age
JANUARY 5 , 1922

INTO·RAILROADS, WOVEN·INTO·CITIES.

How the Government Is Helping Business

Great Progress Made by Secretary Hoover and His Assistants in Improving Service—Commodity Divisions Created—Important Work of Bureaus

BY L. W. MOFFETT

NEVER in the history of the Republic has industry been in greater need of a guiding hand than at the dawn of 1922. Great processes of economic readjustments are spread throughout the universe. There is a vast ebb and flow of the tide of finance, industry, commerce, agriculture and politics. Much remains to be done to complete liquidation and deflation and to quiet political and social unrest. The United States is more nearly free from these disturbances than any other great nation, but necessarily is unable to escape their consequences. Trade cannot be conducted normally where great areas of the world are still in the throes of an abnormal situation, and industry of this country has expanded to such a degree that it must increase its export business constantly. This is true of all the big industries, and assuredly includes iron and steel.

Tendency Toward Stabilization

But perturbed as conditions are, the tendency toward stabilization is progressively encouraging. No satisfactory attempt can be made to indicate what the new year may develop as to recuperation, yet students who have surveyed the situation are confident that prospects have grown considerably brighter. At the same time, it offers a challenge to the ingenuity of those constituting the fabric of business and all of its elements. The keynote to a solution is co-operation. Business, however, requires a chart to point the way to the new era which is approaching. Fortunately, aid is at the disposal of business in the strong hands of the Government and it is desirable that it realize this much more fully than it has in the past, for it has only partially recognized the fact. It is perhaps true that there has been closer association between business and the Government during the past year than at any previous peace-time period. The Government, fully aware of the necessity of giving aid and advice, is showing an exceptional readiness to bring about normal conditions and to assist every branch of business to launch out in greater proportions, both in the domestic and export field. With possibly a relatively unimportant exception here and there, this gratifying inclination is evident, from President Harding down throughout the Government.

The Department of Commerce

Partly because of its function, the Department of Commerce has been and is the outstanding branch of the Government to give aid to business. That department is charged, as Secretary of Commerce Herbert Hoover has said, under act of Congress and by virtue of the desire of the Federal Government, to be generally helpful with the stimulation of the distribution of commodities. The greatest reason, however, for the new and closer relations between the department and industry, for they are decidedly closer than ever, lies in the personality heading the department. Possessed of a remarkable native ability which has been developed through a vast experience acquired under varying conditions at many points of the world, Secretary Hoover—a name known in millions of households throughout the world—has vitalized the department until it has taken on entirely new and greater proportions. His mind has many sides. It reflects the systematization of the engineer, the grasp of a big industrial leader, the poise and imagination of a successful financier, and has the solicitude of a practical humanitarian. Indeed, he has been described as a combination of all of these. Back of it all is a ceaseless energy.

This picture indicates what may have been expected of him as head of the department. It explains why that department has been so widely advertised in the United States and abroad. Mr. Hoover has been and is doing things for American industry. He has a ready ear for representatives in all lines of activities in the country. His many conferences are made up of people who constitute the woof and warp of the nation. Among them are representatives of labor, manufacturing, engineering, trade associations, agriculture, transportation, the daily and trade press, finance, etc. Still, Mr. Hoover is just starting. He does not consider that the organization he heads is yet a "real Department of Commerce," for he says in his annual report that it is not.

Relation to Industry

What, then, is the relation of the Department of Commerce to industry, under its stimulated and growing activities, which Mr. Hoover thinks will not reach their highest efficiency until there is a "thorough reorganization and entire regrouping of the Federal functions bearing upon these functions." By this he meant the giving of service to the producers, manufacturers and distributors of commodities, the ability to provide economic interpretation of importance to the American public generally, and to stimulate American trade and the merchant marine.

Too little interpretation has been applied to the phrase "keep the Government out of business," in the opinion of Mr. Hoover. "There are many lines of business that need the co-operation and assistance of the Government," he has said.

Answers as to the relation mentioned are given best in the statements that have been made by Secretary Hoover, and accompanying expressions by the heads of the three branches of the department most closely associated with industry. These are the Bureaus of Foreign and Domestic Commerce, Standards and Census, of which the respective directors are Dr. Julius Klein, Dr. S. W. Stratton and William M. Steuart, each well qualified for his position.

It will be helpful to summarize the work of the department and these bureaus. The efforts of the department itself have been devoted to reorganization of expenditures, and those bureaus concerned with industry and trade, that they may become of more effective service to the community, as explained by Mr. Hoover.

Appropriations for Next Year

The total appropriations asked for all bureaus of the department and approved by Director of the Budget Charles G. Dawes, for the fiscal year 1923, actually amount to $19,939,970, as against the higher estimates previously made. The decrease was possible despite an enlarged program by reason of a reduction of about $1,000,000 in the expenses of the Bureau of the Census and savings in other directions. The results of the bureaus concerning industry and trade are in part indicated by the increase in volume of demand upon the department for helpful action or information. These demands have reached a rate of approximately 1600 each work day, or over 500,000 a year. This gives a vivid idea of what the department means to industry. Much better results are contemplated.

The most striking improvement in the Bureau of Foreign and Domestic Commerce consists of the creation of 14 new commodity divisions. This development was made possible by an appropriation of approximately $250,000, which became available on July 1. Some of the money represents new funds and the re-

W. N. STEUART
Director Bureau of the Census

DR. J. KLEIN,
Director Bureau Foreign and Domestic Commerce

LUTHER BECKER,
Chief Iron and Steel Division

DR. S. W. STRATTON,
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HERBERT HOOVER,
Secretary of Commerce

mainder money transferred from other activities.

The commodity divisions were created in order that the bureau could be equipped to furnish better service to basic American industries. Before the establishing of these special divisions the bureau had practically no industrial experts connected with its Washington office. The great majority of its personnel, both at home and abroad, consisted of men of more general economic training and experience.

The units of the bureau's organization which concentrate on the geographical phase of export business have also been enlarged and expanded. In place of the old former single European Division, which covered all of Europe, also Africa and Canada, two new divisions have been established, covering Eastern and Western Europe respectively. With the establishment of these two new divisions, the bureau now possesses five geographical divisions as follows:

Eastern European Division, Western European Division, Far Eastern Division, Latin American Division, Near East Division.

Geographical Divisions

The geographical divisions supervise and attend to the preparation of reports and replies from interested American business men from the geographical point of view. This work will often supplement the more specialized commodity service performed in a like manner by the commodity divisions. The commodity and geographical divisions work in the closest harmony in furnishing maximum service to American business from both angles.

Two new divisions of a different character from either commodity or geographical divisions have also been established. They are: Commercial Laws and Transportation.

The Division of Commercial Laws collects and compiles information with regard to the laws of foreign countries which affect the transaction of American business within the borders of such countries. At the present moment, this division is planning a world-wide survey of the commercial laws of foreign countries on a scale conservatively estimated to be far greater than has ever been attempted by a Government agency. With the help of the commercial attachés, trade commissioners and consular officers, this division will shortly canvass the world for information on which to base numerous special booklets.

The Division of Transportation will study problems connected with the movement of freight, both by land and by sea, in an effort to be of assistance to American exporters in solving difficult problems of this kind, and in expediting the movement of American goods to foreign ports.

In line with the general reorganization mentioned, the old familiar daily *Commerce Reports*, known for years to practically every exporting firm in this country and in many foreign lands, has also felt the force of the tidal wave of better service. *Commerce Reports* is now published weekly instead of daily. The new *Commerce Reports* is conveniently arranged and classified by subjects with commodity sections to correspond with the bureau's new commodity divisions. It contains special sections devoted to the work of the Division of Commercial Laws and the Division of Transportaton. Each issue also contains a section devoted to each geographical division. The new weekly, in addition, contains at least one page of "Foreign Trade Opportunities," indicating specific openings to sell American goods. It also refers to available lists of foreign dealers, importers, and other prospective buyers of American merchandise.

Assistant Directors

To take care of the greatly increased administrative work connected with the expansion of the bureau's services, Congress has provided for four assistant directors in place of the two employed heretofore.

In connection with the older units of the bureau's organization, the Research Division plans to improve both the scope and character of the very necessary research work which it performed. There is also the bureau's Foreign Tariff Division. It is planned to improve the services rendered by this division in the supplying of technical and often complicated information regarding foreign tariffs, consular regulations, patent and trade-mark matters, rules governing commercial travelers and their samples in foreign countries, etc.

Commercial Intelligence

Another comparatively new section in the bureau's organization is the Division of Commercial Intelligence. This division is charged with the responsibility of pre-

paring trade lists. The new lists represent a vast improvement over the lists formerly furnished by the bureau. The new lists go about as far as a Government office can go in furnishing details regarding foreign firms. They will show the relative size in each community of each firm listed. They will also indicate the character of the business of each firm.

The bureau has asked in the appropriations sought to continue the 14 commodity divisions already organized and to establish 16 additional ones. These 16 which are proposed would deal with non-ferrous metals, hardware and tools, petroleum, vegetable oils and lead stuffs, meat and dairy products, canned goods, cotton and cotton goods, wool and woolen goods, dyes and drugs, heavy chemicals, paints and varnishes and tanning materials, glass and earthenware, paper, foreign investments, advertising, packing and credit methods, and maps and commercial geographies.

Closely related to the commodity divisions is the division on standardization and elimination of waste, recently set up under the general direction of the Department of Commerce. This division is headed by William A. Durgin, for several years public utility expert for the Commonwealth Edison Co., Chicago, whose activities with that company were similar to those now devoted to the department and industry generally. Mr. Hoover has made it clear that the policy of the division, instead of being to order industry to put into effect certain reforms, is to ask business what the Government can do to help it in its problems.

Of the commodity divisions set up those of most interest to the iron and steel and machinery trades relate to those lines. The practical experience of Mr. Becker, chief of the Iron and Steel Division, and of Mr. Rastall, chief of the Heavy Machinery Division, has been reviewed by THE IRON AGE so that its readers are acquainted with their past work. The operation of their divisions also has been described previously, but supplemental comment by Mr. Becker reflects further the result of work being done by the iron and steel division and efforts under way.

Vitalized Department of Commerce in Brief

Reversing the usual Government order, the department is reorganized on a basis of asking business its needs and then devising practical plans of service.

Efficiency and economy relating to all lines, raw materials, skill in manufacture, labor, and capital underlie the principle for maintaining home markets and developing foreign trade to take care of expanded production.

Restoration and continuance of prosperity is sought by stabilization of industry by wiping out removable fluctuations with their peaks and valleys of trade conditions.

Elimination of waste and sensible policy of standardization instituted, calling for proper methods of production.

Commodity divisions supplemented by others in transportation, commercial law, set up in Bureau of Foreign and Domestic Commerce, with specialists in charge of supplying industry with facts and studies of intimate and vital character. Co-operation with business interests has been extremely close with resulting benefit both to them and the department, co-ordination of interest of all being effected and interdependence of one branch of endeavor on others being developed.

It is also the purpose to develop collective efficiency of American business men, which Mr. Hoover thinks is not so high as their individual efficiency.

Through co-operation with trade associations, trade papers and other sources, the Bureau of the Census publishes vital statistics monthly under the supervision of Dr. F. M. Surface, giving a picture of business conditions and market trend and affording interpretation of future conditions.

The Department of Commerce itself publishes "Commerce Reports" weekly, material being assembled from all parts of the world and grouped according to commodities and other subjects of importance to business.

The splendid service of the Bureau of Standards is receiving increased recognition by industry in consequence of which its work is being broadened.

Mr. Becker's Work

Mr. Becker feels much encouraged over the ready response his division has met with from the various factors in the iron and steel industry engaged in foreign trade. Some of the trade associations and organizations affiliated with the industry have voluntarily established contact with the division, with the desire of co-operating with it to the fullest extent.

"The Iron and Steel Division is young and has only started in its endeavor to be of service to the interested manufacturers and exporters, and has laid plans, which for their successful execution will require the advice and suggestions of manufacturers and exporters who have had long years of experience in the problems encountered in foreign trade, and the support of every branch of the industry," said Mr. Becker.

"The plan and scope of the Iron and Steel Division embrace the following:

"It is proposed to render assistance to the American manufacturers and exporters of iron and steel in not only protecting and maintaining their share of the world's trade, but in finding new fields and opportunities to provide an outlet for the increased capacity of the steel mills as a result of the war; to bring the exporters in direct contact with foreign markets and buyers; and to act as a clearing house for foreign trade information.

"Questionnaires have been prepared by the division for these field men, in which the kind of information desired for the American exporters is outlined in concise but comprehensive form. A list of the commodities covered by the division accompanies the questionnaire, as well as complete specifications of many of them to guide the investigator who may have little knowledge of the marketing of steel products. Suggestions are also made as to where to look for reliable and accurate information. It is desired to secure complete and accurate information, leaving no room for conjecture on the part of the division when interpreting the mass of statistics received. Special investigations will be undertaken in certain sections of the world by men particularly fitted for work of this character. The reports coming to the division from these men will be of special value to the exporters of steel, because they will depict the situation, with respect to a definite trade or industrial center, in complete, accurate and up-to-date form. Foreign periodicals received by the bureau from every part of the world and in a great variety of languages form another source of information for the division.

"Information is being received in the division in increasing quantities, and the problem is to determine how best to utilize it for the best interests of those it is intended to serve. The bureau's weekly *Commerce Reports* is one of the several channels used to disseminate information; another very important medium used is the trade and daily press. Information relating to some definite foreign project or business, in which a certain branch of the industry only is interested, is distributed directly by letter to those firms particularly concerned; confidential and reserve information is sent out in a special circular to those American firms recorded on the bureau's exporters' index. Material not used for distribution is placed on file, where it is available for use in providing answers to the many inquiries being received from those interested or engaged in foreign trade. Co-operation with other divisions of the bureau enables the Iron and Steel Division greatly to supplement its service to the American exporters of iron and steel."

Of great aid to the commodity division chiefs are the commercial attachés and trade commissioners, whose reports have become of a more specialized character and more interpretative than heretofore, and consequently are more important to industry and trade.

The plans of the Bureau of Foreign and Domestic Commerce are to increase the personnel of attachés and trade commissioners. It is proposed to increase the number of attachés from 13 to 15. They would be established for the first time at Havana and Stockholm. Offices already established would be continued at Berlin, Buenos Aires, Copenhagen, London, Madrid, Mexico City, Paris, Pekin, Rio de Janeiro, Rome, Tokyo and Santiago, Chile. One commercial attaché would be appointed at large. The estimate provides for 32 trade commissioners, instead of 18, as at present, and nine assistant trade commissioners, instead of five, as at present.

The Inter-American High Commission was transferred in December from the Treasury to the Bureau of Foreign and Domestic Commerce and Secretary Hoover made chairman of the United States section. The commission is established by treaty with all South American countries and its purpose is to act in common as an advisory body to the various governments in perfecting commercial and financial practices between the different countries.

Bureau of Standards

Ranking among the foremost Government organizations of vital importance to industry is the Bureau of Standards, whose director, Dr. Stratton, has been paid a remarkable tribute by a remarkable man. Thomas A. Edison has classed Dr. Stratton as being 100 per cent efficient. If it is humanly possible to attain such a high standing, it is easy to understand why the rating was given Dr. Stratton. His record reflects the greatest excellence of a man of science. In turn this proficiency is evident throughout the bureau, which is located high on the outskirts of Washington in an appropriate atmosphere of quiet that is conducive to painstaking research and study. Its duties and performances are manifold and its accomplishments are vast. Its functions, as its literature points out, relate to development, construction, custody and maintenance of reference and working standards and their intercomparison, improvement and application in science, engineering, industry and commerce. There is no scientific and technical problem within its wide range that it will not handle, dissect, analyze and work out to the minutest detail. Working standards involving balances ranging from that capable of measuring the thousandth part of a milligram to the large testing machine capable of measuring a load of thousands of tons all come within its purview merely as a fractional part of its work. Engineering students, as well as engineers, business men and many others in miscellaneous walks of life from the United States and foreign countries, are shown through the testing laboratories, seeking and obtaining invaluable information.

The Bureau and Industries

Dr Stratton further explains the relation of the bureau to industries as follows:

"Every one in the United States and particularly our industries are today showing much more interest in the work of the various departments and bureaus of the Government than was the case a few years ago. This is as it should be, and even where the interest is only a desire on the part of some one to increase in a general way the economy and efficiency of Government operation, such an interest is a good thing. With our industries, however, the underlying reason for this getting together of commercial concerns and the Government is more direct and of even greater importance. Industrial concerns have discovered that real service in the shape of good, practical advice can be obtained from the Government, and that this advice will often lead to greater production and increased dividends. Not long ago many manufacturers were unwilling to admit that a Government institution could tell them anything about their particular work.

"The Bureau of Standards of the Department of Commerce has been a pioneer in this work of bringing together the Government and the industries.

"An investigation apparently of interest only from the point of view of pure science will yield results of untold value to several industries. Numerous examples might be given to prove this point, but it is sufficient to say that even pure scientific research work is well worth the hearty support of our industries, for no one of them can tell when they may be recipients of highly important information of direct bearing on their own particular production process.

"Another kind of research work is that conducted with the object of solving some particular problem and is the type more often carried out in industrial laboratories. This work at the Bureau of Standards was prosecuted with great vigor particularly during

Dramatic Year in Foreign Trade

BY DR. JULIUS KLEIN,

Director Bureau of Foreign and Domestic Commerce

"The year which has just closed was without doubt one of the most dramatic in the entire history of the foreign trade of the United States. It has now gone beyond, however, and in the words of Secretary Hoover, 'just as 1921 was the year of liquidation, so 1922 will be the year of restoration.' Careful surveys of foreign fields show unmistakable signs of certain, if slow, improvement. They show also that there is nothing radically wrong with American export trade to-day. The principles of rational merchandising are the same at this moment as before the war. There is no fundamental cause for despondency, but there is a great deal of need for the exercise of prudence and shrewdness. To expedite rapid recovery, there must, of course, be evidence of a greater amount of care in planning sales programs coupled with a thorough understanding of the principles of economic production.

"Fortunately the coming difficult period of 'business restoration' finds the Bureau of Foreign and Domestic Commerce far better equipped than ever before to render essential service to American industries. For the first time in the bureau's history, it is now in a position to get at the heart of America's great export industries, The 'No-Man's Land' of official trade generalities has been crossed. From this time on, the coming together of business and Government for the purpose of trade promotion will be characterized on the part of the Government by an intelligent understanding and appreciation of the needs of business—not alone of its more general requirements, but also of the puzzling details and bewildering individual twists and turns which may be peculiar to each trade.

"This vastly improved and vitally necessary official trade service has come as the result of the creation of 14 special commodity divisions. The men in charge were selected with the help and upon the recommendations of the industries to be served.

"These new services were created for the special benefit of American industries and their facilities are at the complete disposal of all American manufacturers. They are in working order now and are being used to advantage by many American business men. A most cordial invitation is extended to the readers of THE IRON AGE *to call upon the commodity divisions or any other service of the Department of Commerce for advice and assistance in connection with any matter related to trade promotion. No problem, no firm or no individual is considered too large or too small."*

the war. The difficulty and in some cases the impossibility of securing certain materials and appliances from abroad made necessary the development of similar things in this country.

"When the manufacturers were virtually forced into unfamiliar lines of work, they turned to such institutions as the Bureau of Standards for the fundamental information which is always absolutely essential in starting any new production process. As a result of the war, very close co-operation now exists between the bureau and many of the foremost industries of the country.

"This is particularly true in the case of metallurgical work which may be taken as an example of the industrial research work of the bureau. Realizing the great importance of scientific investigation in this field, the bureau has provided a special division to care for such problems. Its laboratory is the best equipped in the world for general research work on both ferrous and nonferrous metals and alloys. As in several other lines, the bureau realizes that only by the study of actual manufacturing processes can real improvements be made. For this reason the equipment of the division includes a small experimental foundry, rolling mill, many different types of furnaces, a forging press, draw bench, etc., so that the actual processes conducted in a commercial plant can be studied on a small scale.

"The members of the bureau's scientific staff serve on many committees of manufacturers and industrial associations and through the contact thus established, the industries of the country are kept in close touch with the fundamental research work in progress at the bureau. Practically all the industries now realize the value of an unprejudiced general research organization which can take up those difficult and fundamental problems which are of interest to an entire industry rather than to the individual manufacturer.

"Through a system of research fellowships, which has now been in operation for some time, industrial organizations can send to the bureau a representative to work upon particular problems of interest to that industry. This research fellow is given the use of the bureau's laboratories and the advantage of association with the bureau's scientific staff. The funds for the development work are provided by the organization which sends the representative, and it is stipulated that the results are to be used as the bureau sees fit for the benefit of the industry as a whole. Advantage has been taken of this arrangement by numerous manufacturing concerns and industrial associations.

"A great opportunity exists for standardization in sizes and production methods, and the bureau has already done valuable work in this field. However, a start has hardly been made in comparison with what might be done in this as in other lines of industrial standardization.

"In closing, it should be pointed out that this important need for industrial research by such institutions as the Bureau of Standards can be met only if the bureau is granted the hearty support of all our industries. The work in some lines has only recently been started and in others has not even been commenced. The next few years ought to witness a steady growth in this class of research work, and it is to the interest of every manufacturer to further such a development, as upon scientific research of this sort will depend the future success of our industries."

"Probably few persons," said Director Steuart, "other than those connected with the census realize the magnitude of this undertaking and the difficulties of carrying it to completion within the three year period prescribed by law. It involves the printing and distribution of 25,000,000 schedules of questions; the organization and supervision of a force of over 90,000 enumerators and special agents employed to make a house-to-house canvass of the entire United States—including all the outlying possessions except the Philippines and the Virgin Islands—and to fill out schedules for 107,500,000 peope, 6,500,000 farms, 450,000 manufacturing estabishments, and 22,000 mining and quarrying enterprises; the examination, checking, and editing of the schedules when received; the punching of 300,000,000 tabulation cards; the running of the equivalent of over 2,500,000,000 cards through electrical sorting and tabulating machines; the computation of about half a million percentages, averages, and other rates; the preparation of elaborate manuscript tables; and, finally, the printing and publication of 12 or more quarto volumes averaging about 1000 pages each."

"Believing that there thus exist a great opportunity and a great need for the adequate analysis and interpretation of census figures and their application to the live questions of the day, the bureau, acting upon the earnest recommendation of the advisory committee, plans to prepare and publish, after the close of the decennial census period (June 30, 1922) a series of interpretative special studies or monographs on various subjects within the scope of the census; and I believe that this project, if it can be successfully carried out so as to realize or approach the standard of excellence which we hope to attain, will greatly increase the value and utility of the census to the public," Director Steuart says. The bureau is now publishing interesting industrial statistical data in its "Survey of Current Business," a new enterprise that has been well received.

The bureau's work is conducted by a staff of 850 employees, housed in 13 laboratory buildings. It has a technical library of nearly 22,000 volumes, and a range of subjects and variety of equipment unique in research laboratories. The research results are made available to the industries through the Bureau's publications, of which nearly 800 have been issued. During the fiscal year the bureau issued 86 new publications, comprising 33 scientific papers, 27 technologic papers, 18 circulars, 3 handbooks, and 5 miscellaneous publications. A technical news bulletin, issued each month, descri es current investigations in progress and results obtained in the laboratories.

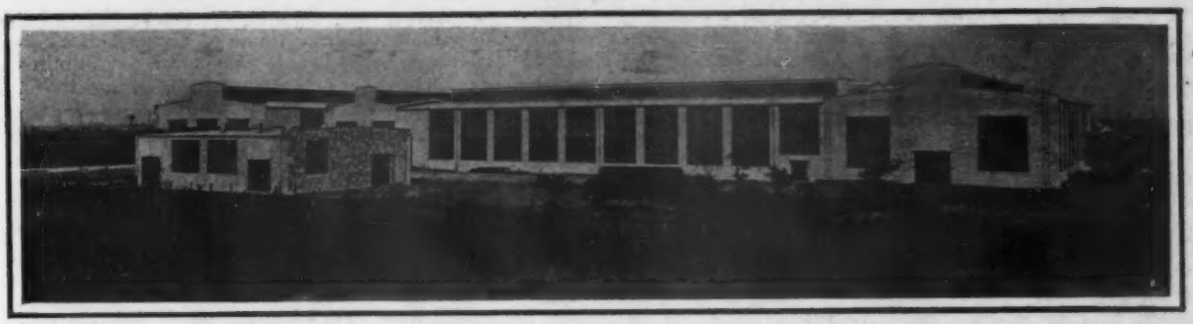
Cost of Operation

This sketch of the activities of the Bureau of Standards, although inadequate, gives a bird's-eye view of its work. And for all the splendid service it gives and offers to industry, its cost of operation is absurdly small. For the fiscal year of 1923, its estimates carried in the budget total only $1,762,560, as compared with an appropriation of $1,570,360, and $1,847,560 requested. Of the estimates $40,000 is for metallurgical research, the same is allowed in existing appropriations, but $10,000 less than was asked for 1923.

It is all too common for the work of constructive Government agencies to be misunderstood and insufficiently appreciated. Despite the fact that its duties require it to get into touch with every institution and family in the United States and its possessions, comparatively little is known of the functions of the Bureau of Census and their vital bearing on industry and all other activities of the broad sweep of life it affects.

During the fiscal year ended June 30, 1921, the second of the three years constituting the decennial census period, the bureau completed the field work of the census, brought well toward completion the tabulation of the results, and published a considerable part of the statistics in bulletin form. The preliminary announcement of the total population of the United States was issued on Oct. 7, 1920. State bulletins on population, agriculture, manufactures, and other subjects covered by the census are being published and in addition, thousands of press summaries have been prepared and sent out. Thus the information collected for the fourteenth census has been given to the public with the least possible loss of time, and a very considerable part of it will have been made available for use long before the publication of the last of the bound volumes constituting the final reports.

This brings to a close an attempt to outline the relation of the Department of Commerce to industry. It comprehends only a part of such a big subject. But it is hoped it will bring about a greater realization of its value and increase cooperation, so greatly stimulated during the past year. It surely must be appreciated that industry is offered splendid returns on an annual investment of approximately $20,000,000. It will indicate that the department is a safe guide to greater things for industry.

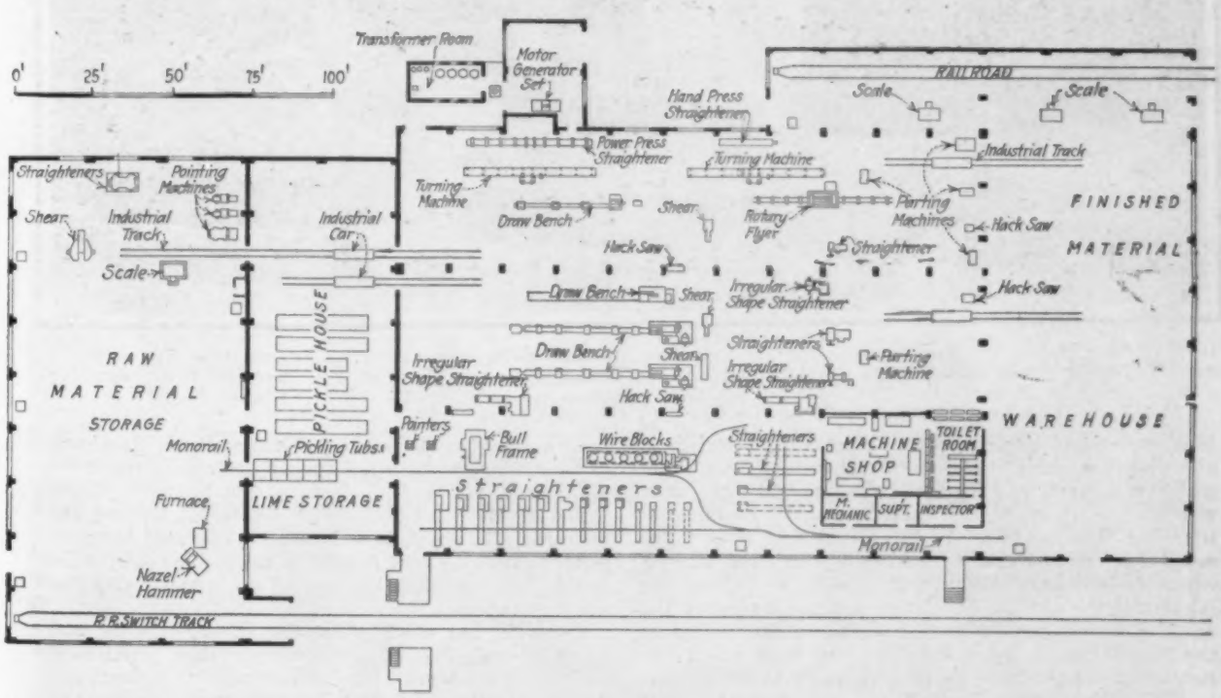


LaSalle Co. Completes Cold Drawing Plant

Designed for Handling Products in Maximum Lengths—Raw Material Protected from Elements—Plan Anticipates Expansion

BY GILBERT L. LACHER

QUALITY, rather than quantity production, is the main desideratum in a plant manufacturing cold drawn steel bars and shafting. Maximum output is important in the sense that economy in operation is the aim of every manufacturer, but the necessity of producing material which will pass the rigid specifications imposed on cold finished steel demands more than usual care in the handling of material in process and in the inspection of a finished product. The recently completed plant of the LaSalle Steel Co., at Hammond, Ind., was designed and is being operated with heed for these considerations. The plant layout is such that the progress of the product is uninterrupted from the raw material to the finishing ends. A large warehouse has been provided for incoming raw material, to protect it from the elements Railroad sidings enter both the raw and finished material warehouses, thereby facilitating the movement of both incoming and outgoing products. The plant site comprises 35 acres and one side of the main building is constructed of hollow tile, so that all of the departments, or any one of them, may be extended as the future needs of the business may require. The plant was designed and equipped to handle material in maximum practicable lengths, bars up to 41 ft.



In the Layout of the Plant, Provision Is Made for "Straight-Line" Routing of Material, from the Raw Material Storage at Left, Through Pickling Vats and Draw Benches, to Finished Material Warehouse at Right

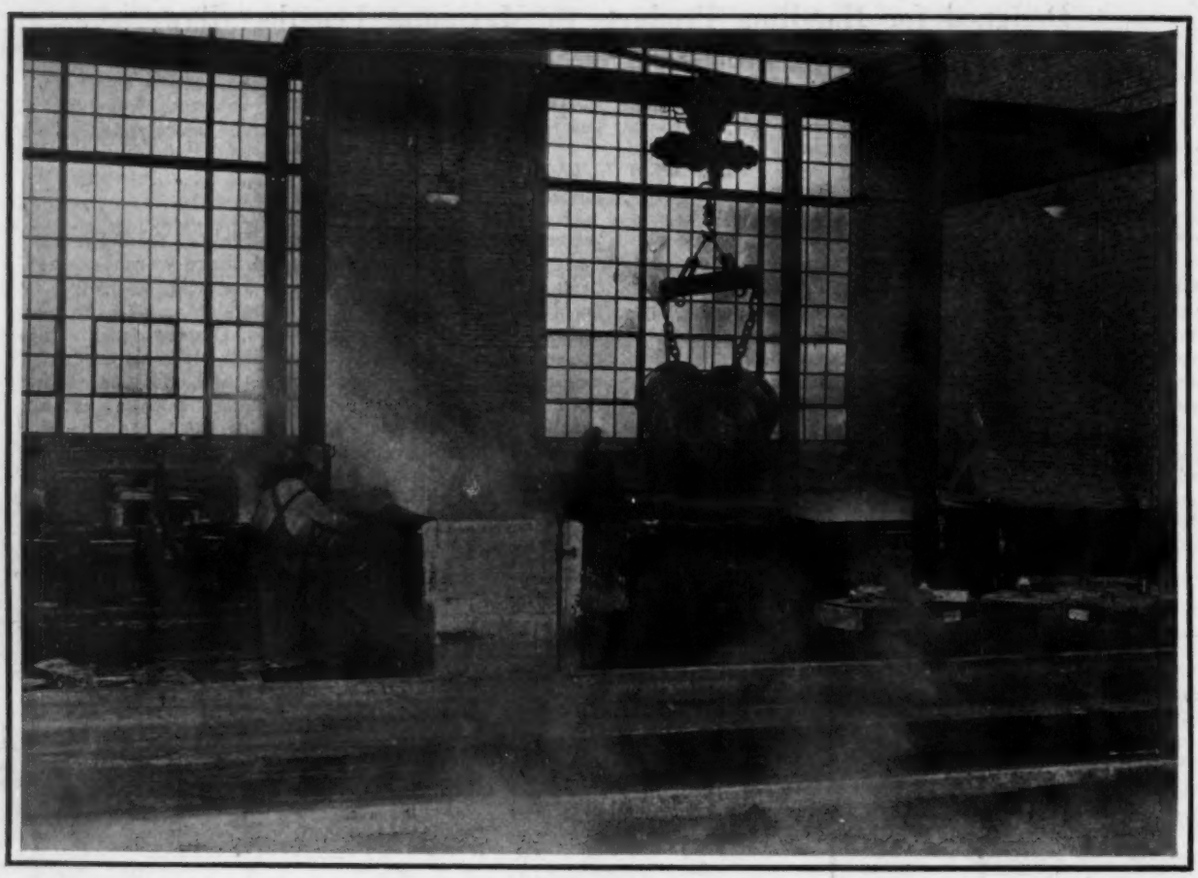
long being drawn and finished. Special attention has been given to the inspection of material, both in the process of manufacture and in the finished state.

The LaSalle plant consists of three buildings, a boiler house, 50 x 57 ft.; an annealing and heat treating department, 60 x 80 ft., containing a furnace of 25-ton capacity; and the main structure. The latter comprises raw material warehouse, pickling room, manufacturing department and finished material warehouse. This building, which is approximately 175 x 445 ft., contains 77,875 sq. ft. of floor space. It is built of structural steel, with an exterior of brick on all sides except that to which extensions are expected to be made. Continuous sash on the sides and in the roof monitors insure ample light in all parts of the plant.

All raw material is stored under cover in a warehouse, located at the end of the building farthest from the railroads adjacent to the property. A railroad siding enters one end of the warehouse, and here material is lifted out by a 10-ton Northern Engineering Works overhead electric traveling crane, by which it is distributed throughout the room. The crane drum from which the steel is suspended was made longer than usual, about 15 ft. in this case, to prevent swaying in the long bars handled. In this connection it is to be noted that raw material is ordered in maximum lengths which freight cars will permit—up to 40 ft.; at the request of the LaSalle company, cars are loaded by the mills in 5-ton lifts. Material is thence distributed in the warehouse in 5-ton bundles, and throughout the process of manufacture an effort is made to handle material in these units: four, five or six lifts of 5 tons each at a time. This method eliminates frequent weighing, which would otherwise be necessary in handling steel against specific orders, and facilitates the checking of the progress of material throughout the plant.

Material of small cross section is handled in coils, rather than in straight bar form. After the weights of a few representative coils out of the same shipment have been ascertained, a fairly accurate estimate of an order may be made by multiplying the number of coils used by the sample weight. Some of the coil stock is pointed in the warehouse before passing on to the other departments. This work is done on a motor-driven hammer, furnished by the Nazel Engineering & Machine Works, Philadelphia. Previous to pointing, the material is generally heated in a Strong, Carlisle & Hammond Co. oil furnace. This precaution is taken to prevent brittleness, which sometimes results from hammering. For the straight bar stock, three pointers have been provided, which will handle rounds up to 2½ in. Other equipment in the raw material warehouse includes a 5-ton dial scale furnished by the American Kron Scale Co., New York; a shear which will cut material up to 3 in. in cross section, manufactured by Doelger & Kirsten, Milwaukee, and a rotary straightener built by the Abramsen Engineering Co., Pittsburgh, through which all stock to be turned is passed before going on to the other departments.

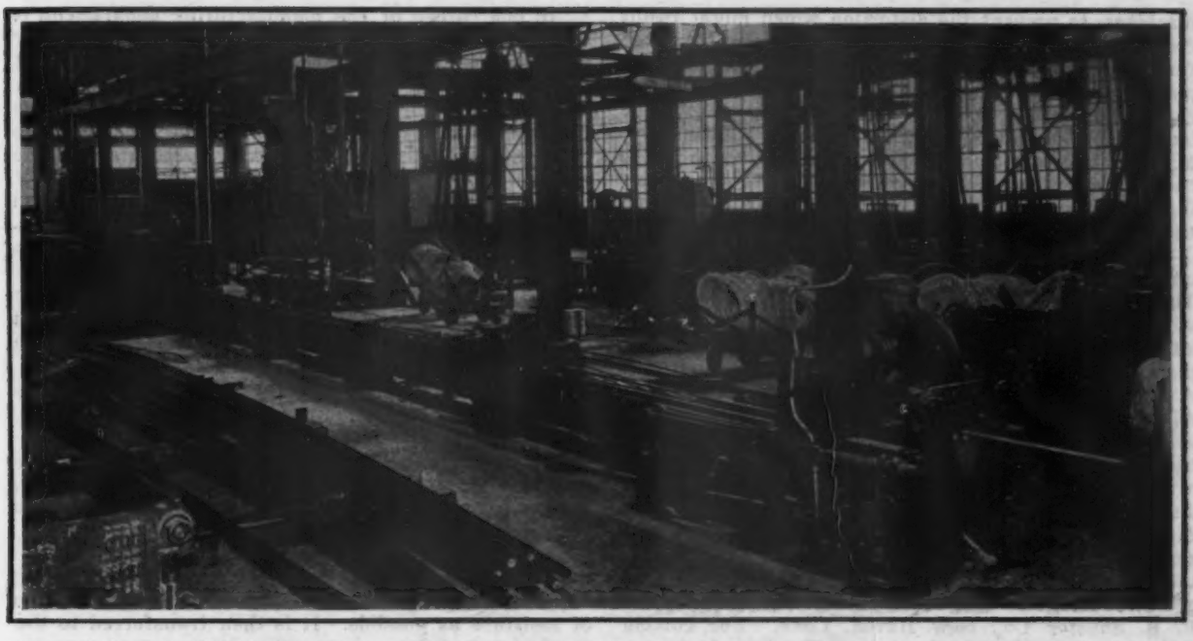
Straight bar stock and coils are handled separately, from the raw material warehouse through the intervening departments to the finished material warehouse. For handling the coils a monorail system equipped with four 2-ton hoists furnished by the Shepard Electric Crane & Hoist Co., Montour Falls, N. Y., has been provided. Three of these hoists are operated from suspended carriages; the fourth, in the pickle room, is controlled from the floor, because of the fumes rising from the pickling vats.



In the Pickle House Are Two Departments, for Coils and Straight Bars, Respectively. The coil tubs are served by overhead monorail, as shown, while the long vats, two of which appear in the immediate foreground, are served by overhead traveling crane

Straight bar stock is handled throughout the plant by overhead traveling crane (within each department) and industrial truck (from department to department). As the movement of stock from the raw material storage is all in one direction, the industrial tracks are laid on a slight grade, so that only a light pressure is required to set the industrial car in motion. These cars, designed by the company's engineers, are long, flat, narrow gage equipment, suitable for handling long bars.

Adjacent to the raw material warehouse, the pickle house consists of two departments, one for coils and the other for straight bar stock. The coil tubs—three for



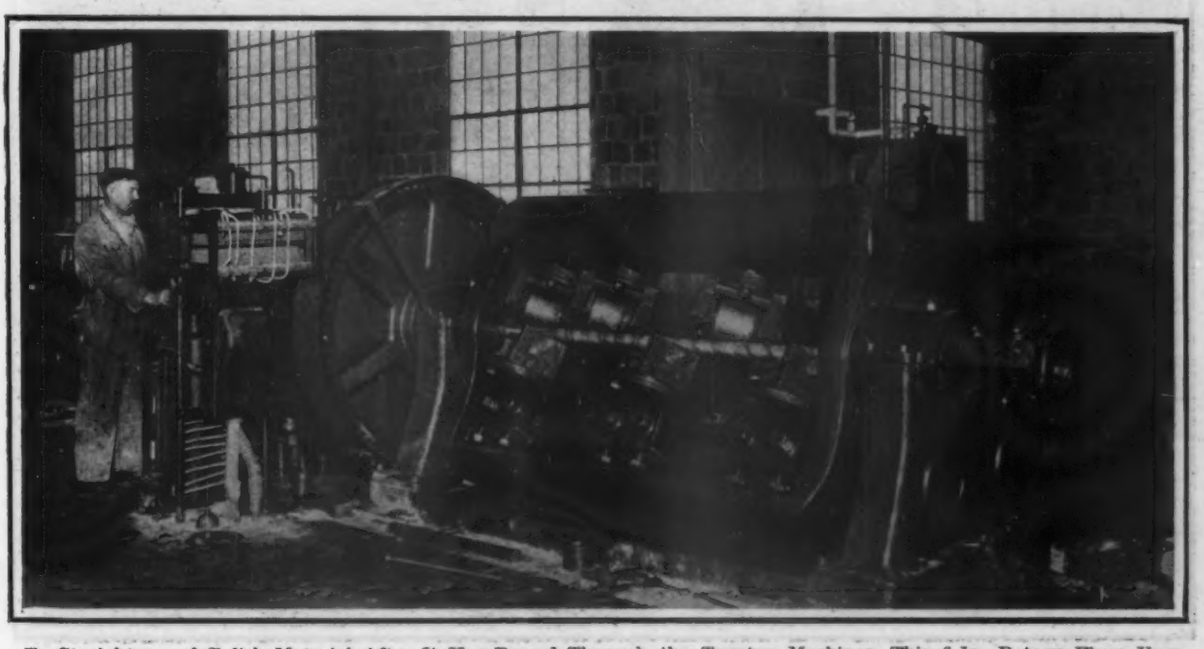
Two of the Draw Benches Are Equipped with Pushers Which Point the Stock Before It Is Drawn, Thus Eliminating Necessity of Using Separate Pointing Machines. One of these benches appears here

acid, one for water and one for lime—are located directly under the path of the monorail hoist. The tubs are made of wood and set in concrete depressions in the floor. Six long wooden vats, commanded by a 5-ton Northern overhead electric traveling crane, have been provided for straight bar stock. Of these, one contains water, one lime, and four acid. Four of these vats are 41 ft. in length, while two of the acid tanks are 32 ft. only.

The company considers pickling the most important step in its process of manufacture, and has a chemical engineer in charge who is responsible for the practice employed. The aim is to secure a complete removal of all scale from the steel without permitting the acid to eat into the surface, and at the same time to obtain a thorough removal of the acid subsequent to pickling, without incurring bad after-effects, such as brittleness. The steel is pickled, in a solution of sulphuric acid and an undisclosed compound, for from 30 to 45 min., after which it is placed for brief periods in the hot water and lime vats. The coating of lime serves as a lubricant during the subsequent drawing of the steel.

Three parallel bays, two for straight bar stocks, and one for coils, house the manufacturing department. The equipment for handling straight bars includes two turning machines and four draw benches. Both turning machines, one of which is a 4-in. and the other a 6-in. machine, are equipped with one roughing and one finishing tool, and have beds which will handle bars up to 40 ft. long. Adjacent to these machines is a power press straightener, which will take rounds up to 6 in. in diameter, and a hand press straightener which is held in reserve for any overflow in production. The material is put through the power press straightener before turning, this being the second straightening to which the stock is subjected, the first being in the raw material warehouse.

After turning, the material is passed through a 6-in. rotary flyer for straightening and polishing. The rotary flyer takes out all sweeps in the bars, but as an added precaution, to remove any slight kinks not visible to the eye, all shafting is again passed through the power press straightener before going to the parting machine. Finished shafting is run through parting



To Straighten and Polish Material After It Has Passed Through the Turning Machines, This 6-In. Rotary Flyer Uses Wood Polishing Blocks, Fastened in the Projection Shown at Right End of the Machine. The heavy rollers in the frame do the straightening as the frame revolves at high speed

machines, to prevent the distortion which might result from shearing. Some screw machine stock too large for shearing is also put through parting machines. The plant has five of these machines altogether, ranging in capacity from 1½ to 6-in. rounds. They were made by the Hurlbut, Rogers Machinery Co., South Sudbury, Mass., but certain modifications in their operation have been made by the LaSalle engineering staff. For shearing screw machine stock, three Doelger & Kirsten shears with capacity up to 3 in. have been provided.

Of the four draw benches, two will handle material up to 42 ft. in length, and the other two up to 30 ft. The two long machines have pushers which point the stock before it is drawn, thereby eliminating the necessity of the use of separate pointing machines. It is planned also to fit the smaller benches with pushers. A feature of the drawing equipment is its flexibility. All of the benches may be used for drawing irregular shapes, as well as rounds, and three are fitted for multiple drawing. Each bench is equipped with delivery arms, which raise the material after it has been drawn and drop it on adjacent horses, which carry rollers to facilitate the handling of the steel. Each bench is served with a round straightening machine, built by the Medart Pulley Co., St. Louis, and in addition there are three irregular shape straighteners, supplied by the F. B. Shuster Co., New Haven, Conn. For cutting irregular shapes four hacksaw machines have been provided.

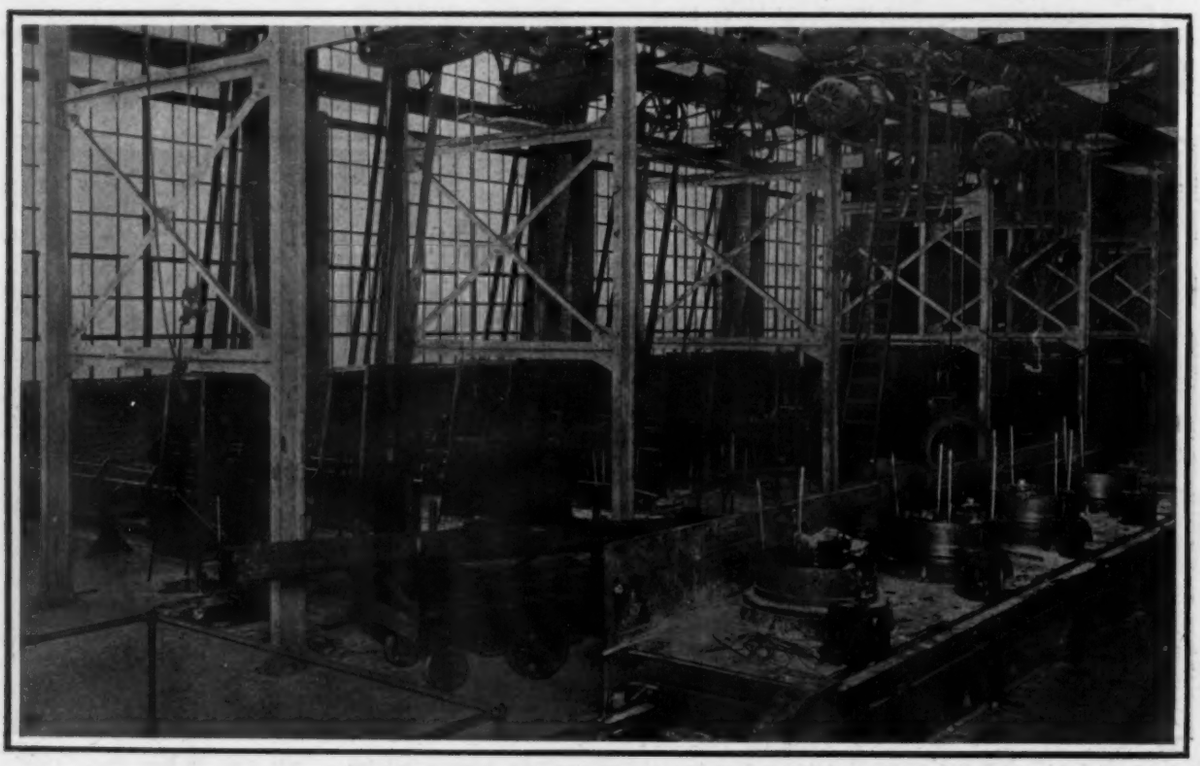
In the coil bay, larger gage stock is drawn through a double-drum bull frame, built by the Morgan Construction Co., Worcester, Mass. This machine will draw material up to 1 in. in diameter, one drum being arranged for drawing shapes and both drums for drawing rounds. Pointing for this machine may be done either in the raw material warehouse or on two pointers located in the coil bay near the entrance to the pickling department. For drawing sizes smaller than ½-in. four wire blocks, equipped with roll pointers, have been provided. Twelve Shuster straighteners, in a row, finish bars up to 12 ft., which is the ordinary length for screw machine work. In addition, two Shuster straighteners are used to finish bars from 14 to 24 ft. in length. Driven from line shafting, these straighteners automatically straighten, polish, and cut material to length in diameters ranging from ⅛ to ¾ in.

In one corner of the manufacturing department is a machine shop, where all dies are made and repair work and modifications and changes in the equipment are handled. The company also does its own carpentry and electrical work, aiming to be as self-contained as possible. The draw benches, the turning machines, the rotary flyer, the irregular shape straighteners, and the monorail system are operated by d.c. motors. All of the manufacturing units, except the Shuster round straighteners, are driven by individual motors. Current, bought from the Northern Indiana Gas & Electric Co., is stepped down from 10,000 volts a.c. to 440 volts.

There are five Northern overhead electric traveling cranes, one of 10 tons in the raw material storage, and 5-ton cranes in the pickle house, the finished material warehouse and in two of the three manufacturing bays. All cranes are capable of taking an overload of 25 to 50 per cent. All are equipped with long cable drums, similar to the one in the raw material storage previously described, except that in the manufacturing bays the drums are at right angles to the bridge of the crane, the purpose being to keep the drum parallel to the material handled.

After material has been finished in the manufacturing department it is thoroughly sprayed with a flushing oil, free from acid and containing as small a percentage of moisture as possible. It is then transferred to the finished material warehouse. The joint storage capacity of the raw and finished material warehouse is 18,000 tons, and the manufacturing capacity of the plant is 6,000 tons a month. The output divides itself into two classifications, screw machine stock and shafting. For the former it is unnecessary that material be delivered in specific lengths. Orders for shafting, however, specify the length as well as the diameter of the stock. As an aid to the flexibility of the shipping department, shafting is ordinarily carried in lengths of 40 ft., which is a multiple of most of the sizes likely to be specified.

In the operation of the LaSalle plant, the works superintendent has no control over the finished material warehouse. The purpose of this division of authority is to prevent the head of the manufacturing department, who is naturally interested in the maximum output at minimum cost, to ship out any material not strictly up to specifications. The head of the shipping department is held responsible for all material leaving



Four Wire Blocks Equipped with Roll Pointers, Shown in Right Foreground, Are Used to Draw Steel in Sizes Smaller Than ½ In. Diameter. Behind them is a battery of twelve straighteners

Coil Stock of Larger Cross Section Is Drawn Through a Double-Drum Morgan Bull Frame, Which Will Handle Material Up to 1 In. in Diameter. Both drums are arranged for drawing rounds, and one for drawing shapes

his hands, and to this end is authorized to turn back to the manufacturing department all steel which does not pass his inspection. Frequent inspection is also required throughout all of the previous operations. Material is not permitted to pass from one department to another if it does not meet specifications. The effectiveness of inspection is probably to be attributed to the employment of a cost system, of which it is an incident.

As previously indicated, work is put through the plant in lots which are multiples of 5 tons. To facilitate this procedure a production order is made out in multiple, the office copy of which shows the amount of raw material to be used in terms of pounds, number of bars, size, shape, length, etc., the finished material to be made, in the same terms, and the specific orders against which the finished product is to be applied. Each production order is numbered, and the date on which it is sent out is registered on the office copy, and also on the raw material requisition which goes to the raw material warehouse. Copies of the order are attached, for each department through which the material will pass. On these copies are provided spaces for the insertion of the name of the foreman handling the work, the time required to perform the operation, the number of men employed on the job and the date on which the work is completed.

Before a department head will accept a production order, however, he inspects the material delivered, and in case it does not meet specifications, turns it back to the previous department. As soon as an operation is completed and material is passed on to a succeeding department, the copy of the production order showing the work completed, is returned to the office. This practice not only gives the management an accurate check on costs as compared with the previous costs for similar operations, but also enables it to keep track continuously of material in process. Separate copies of each production order go to the raw material warehouse, the pickle house, the pointing machines, the turning or drawing departments, the straightening machines, the cutting department and the shipping department.

The LaSalle plant has the advantage of excellent railroad facilities. Its sidings connect with the Pennsylvania Railroad and with two belt lines, the Elgin, Joliet & Eastern, and the Indiana Harbor Belt. The plant is only four miles from a large transfer yard at Gibson, Ind. One of the two switch backs serving the plant enters the shipping department, where box cars are spotted for loading. Raw material is weighed before shipment, three 5-ton Krone scales being located at convenient points on the shipping platform.

RATE INVESTIGATION

Cost of Production of Iron and Steel Products Will Be Involved

WASHINGTON, Jan. 3.—The bearing of present freight rates on the cost of production of iron and steel products and their effect on the market, together with a large volume of other facts, will be brought out in the course of hearings before the Interstate Commerce Commission when it resumes proceedings in the general rate investigation case. The date has been postponed from Jan. 9 to Jan. 11. From Jan. 11 to Jan. 18 the time will be devoted to direct testimony of the carriers and cross examination of their witnesses.

Then follows the presentation of the side of the shippers to be opened with subjects concerning the iron and steel industry. On Jan. 19-20 the coal and coke situation will be submitted, while on Jan. 21-23 the hearing will deal with ore, furnace materials, and iron and steel products. This gives representatives of the industry four days to present their views and they are said to be prepared to submit a wealth of figures and observations as to the effect present high rates have on the industry, the absolute necessity of reducing them, and to go into the question of relationship of raw materials to manufactured products. This latter, however, is a subject of disagreement among rate authorities and opposing views have been expressed by representatives of the industry itself. The latest demonstration of this was in connection with informal conferences before members of the commission by Lake front iron and steel and interior iron and steel producers. The fact that the commission, as the upshot of these conferences, restored iron ore rates from Lake Erie ports to their previous high level, effective Jan. 1, has led some to think it takes the attitude that there is a direct relationship between rates on raw materials assembled to produce pig iron. This position is taken by reason of the fact that the Lake front manufacturers claimed it was discriminatory against them to permit interior furnaces to enjoy reduced rates on iron ore without allowing lower rates on coal and coke to Lake front plants. At the same time formal opinions of the commission have been handed down which do not uphold this theory.

Electrolytic Iron a Commercial Product

The Eustis Process Compared with Others—An Ore Instead of Scrap as the Anode—Tests and Properties —Fields of Usefulness

BY BRADLEY STOUGHTON*

FOR more than 50 years attempts have been made to produce pure iron on an industrial scale by means of electrolysis, which modern metallurgy recognizes as the "tonnage production" method for metals in a pure form, and which is the established process since a number of years for pure copper, gold, silver, aluminum, lead, zinc, etc. The combination of unexcelled cheapness with unexcelled utility for many purposes, possessed by *impure* iron, has diverted attention from the superior utility of the *pure* metal over pure copper, aluminum, etc., at a fraction of the price. We now know that pure iron is at least as soft and has better cold-working or drawing qualities than either pure copper or aluminum, besides having great advantages for household and machine purposes in respect of price, durability, maintenance of a bright surface, resistance to corrosion or tarnishing, to heat, etc.

Speculations as to the properties of pure iron—that is, iron of at least 99.99 per cent Fe.—which have been based upon researches carried out on metal having 99.50 per cent purity, are now known to be well below the actual quality of the metal in such properties as softness, malleability when cold, ductility, magnetic qualities and, probably, resistance to corrosion. The extension of opportunities for research offered by the present industrial production of pure iron on a tonnage scale opens up a fascinating field of investigation for universities, research laboratories and others, with bright promise of discoveries having both scientific and commercial interest and importance.

Specimens of electrolytic iron exhibited in museums as "rarae aves" may now be relegated to positions of mere historic value, because at least two industrial establishments are producing yearly hundreds of tons of metal having equal or greater purity than they possess. One of these plants is at Hawthorne, Ill., a second at Grenoble, France, and rumor has it that the Germans, under the stress of need for a metal with the softness of copper, produced noteworthy quantities of electrolytic iron during the war by the Fischer-Langbein-Pfanhauser process. And even in this brief summary mention should be made of the work of C. F. Burgess in America, and Cowper-Coles in England, because both contributed valuable aid to the final success of this useful and important industry.

*Consulting metallurgical engineer, New York.

Process of the Société "Le Fer"

The Société "Le Fer," which numbers among its directors the eminent metallurgist, Dr. Léon Guillet, controls the patents of Anthèlme Boucher, which were under laboratory investigation for several years prior to 1915, when the first industrial installation was made at the iron and boiler works of MM. Bouchayer and Viallet at Grenoble, France, using electricity from

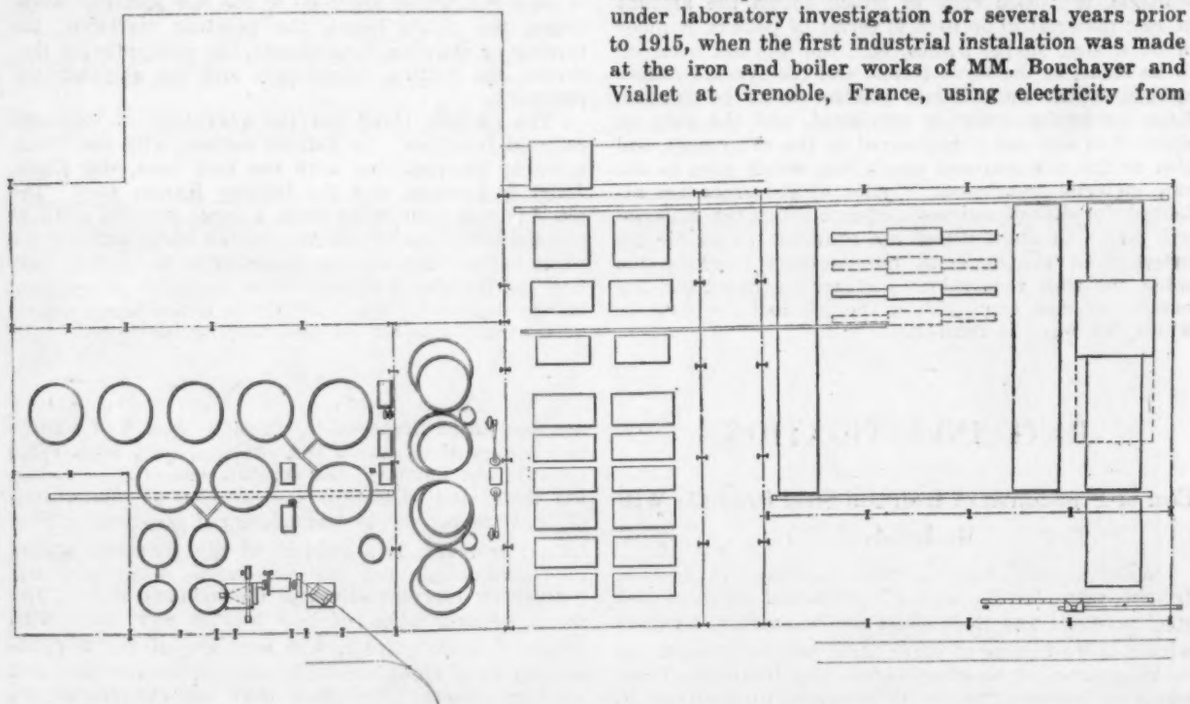


Fig. 1—Electrolytic Iron Plant Laid Out on the Unit System So As to Be Capable of Duplication. The pyrrhotite is delivered to the plant crushed through 200 mesh and concentrated by flotation so as to be practically free of any soluble impurities such as lime, magnesia and zinc

The Leaching House Contains: 4 first agitators mechanically agitated; 2 Dorr single tray thickeners; 4 final agitators mechanically agitated; 2 final Dorr single tray thickeners with the necessary filter presses; 4 cementation tanks for precipitation of copper; 3 overhead feed tanks and 2 heater tanks in which electrolyte is heated. There are also the necessary pumps and acid-proof transmission lines where necessary

The Cell House Contains: 2 or 3 acid-proof pumps for electrolyte circulation; 132 cells for deposition of 10 tons of 6-in. tubes $\frac{1}{8}$-in. thick per day; 2 wash tanks for cathodes; 2 racks for mandrels; 2 racks for cathodes; 2 electric overhead traveling cranes and 1 transfer table

The Stripping and Drawing Room Contains: 1 storage rack for mandrels with tubes thereon; 1 electric annealing furnace; 2 motor-driven strippers; 1 tube rack and 2 tube draw benches with necessary conveyors

The Finishing and Shipping Department Contains: 1 tube storage rack; 1 tube conveyor; 1 cold saw; storage skids for finished tubes; 1 scrap hopper and 1 scrap conveyor

hydroelectric plants in the Swiss Alps. The process and works have been so well described and illustrated in the technical press, and especially by Guillet in *Revue de Métallurgie*, Mémoires, 1915, February, page 82, and by Jean Escard in *Le Génie Civil*, 1919, Aug. 23 and following issues, that details may be omitted here.

The electrolyte is ferrous chloride; the anode is iron in the form of cast iron; the cathode is a revolving mandrel upon which the pure iron (containing about

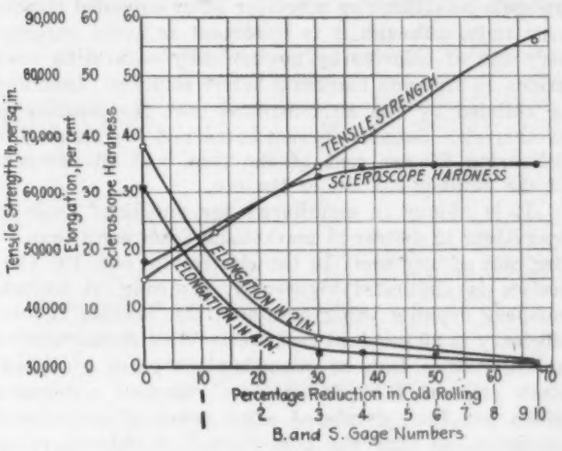


Fig. 2—Characteristic Curves of Electrolytic Iron

99.97 per cent Fe.) is deposited in the form of a tube, which is annealed to eliminate the embrittling hydrogen, stripped and used as a boiler tube, either with or without drawing through a die.

The metal is so soft that no inner "ball" is used in the drawing operation. The 0.03 per cent of impurity is made up of the metalloids of the cast iron, namely: Traces of carbon, silicon, sulphur and phosphorus. Hydrogen, which deposits with the metal, is completely eliminated by heat, as indicated by chemical analysis and physical properties, which will be described later. I have before me not only the two French monographs mentioned above, but also a thorough professional report by a Swiss engineer, and two independent reports by American engineers, each of whom made a couple of visits to the Grenoble plant, where every opportunity

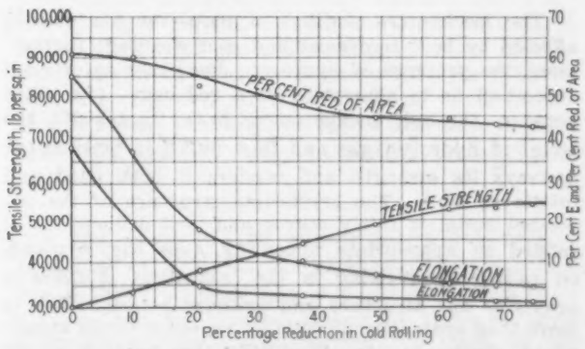

Tensile Strength, lb per sq in
Per Cent E and Per Cent Red. of Area
PER CENT RED. OF AREA
TENSILE STRENGTH
ELONGATION
ELONGATION
Percentage Reduction in Cold Rolling

Fig. 3—This Characteristic Curve of Electrolytic Copper Represents the Change in Physical Properties Which Accompanies Cold Work on the Metal. The abscissae represent percentage of reduction in cold rolling

was afforded them by M. Bouchayer for inspection of the process. From the commercial viewpoint the Boucher process gains by avoiding the following operations in the making of a boiler tube: Purifying the pig iron; rolling and piercing the billet; annealing and rough-shaping the tube. The costly items are as follows: Cast iron for anodes;* loss of about 20 per cent in slimes due to the use of a soluble anode; and the use of electricity, which amounts to about one-quarter to one-third of a horse-power year per ton of tubes produced.

In the matter of purity the Boucher tubes excel any other industrial product, and the process has the great advantage that a thin tube, which is the most costly to make by the prevailing boiler tube process, is the cheapest to make by the electrolytic process. M. Bouchayer says that he is able to meet all commercial competition in producing thin tubes, and he plans the construction of a second plant relatively near Grenoble, which would have double the capacity of the present plant.

*Furthermore, a very impure cast iron must not be used, because some of the metalloids will migrate to the cathode.

Process of the Western Electric Co.

The research departments of the American Telephone & Telegraph Co. and the Western Electric Co., in seeking a commercial process for the manufacture of pure iron in a pulverized form, employed the very ingenious expedient of utilizing the hardness and brittleness of electrolytic iron from which the hydrogen had not been eliminated, in order to get the material into a finely powdered form and compress it into magnet cores which would have high electrical resistance because the particles were not soft enough to crush together into a unit mass. When these operations were concluded, the compressed cores were baked to remove the hydrogen, leaving pure iron particles.

This process proved cheaper and better than reducing the iron powder by hydrogen from the oxide. A commercial electrolytic iron plant was therefore equipped at Hawthorne, Ill., with a capacity of about two tons of iron per day. This method of securing pure iron proved to be relatively inexpensive and to afford a

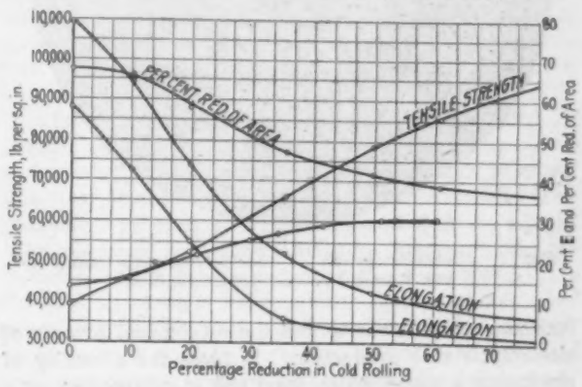

Tensile Strength, lb per sq in
Per Cent E and Per Cent Red. of Area
PER CENT RED. OF AREA
TENSILE STRENGTH
ELONGATION
ELONGATION
Percentage Reduction in Cold Rolling

Fig. 4—Characteristic Curves of Tubing Metal

ready means of controlling the quality of the material.

The cores of the loading coils which are introduced at regular intervals to increase the inductance of a telephone circuit are now made of this material. The electrolyte is of ferrous sulphate and chloride and ammonium sulphate; the anode is mild steel; the cathode of polished sheets of steel, from which the deposited metal is stripped when it has reached a thickness of ⅛ to ¼ in.; the current density is about 12 amperes per sq. ft. A brief description of the plant and process is given in the *Journal* of the American Institute of Electrical Engineers, July, 1921, pp. 598, 599, 608, and 609. The magnetic and electrical properties of the material and the completed cores are described on pp. 600 to 608.

Electrolytic Iron Direct from Ore

The deposition of iron by electrolysis is from the electrolyte directly on to the cathode. The use of a soluble anode is only a means of keeping the electrolyte supplied with iron. Any other means of accomplishing the same result would give the same deposition, electrical efficiency, etc. For example, the circulation of the electrolyte, always maintaining it up to the desired standard of iron content, would effect the electrolytic action and avoid some disadvantageous features, such

as the economic waste due to the loss in slimes with the soluble anode, the migration of impurities from anode to cathode, etc.

This is the novelty introduced by Frederick A. Eustis and Charles P. Perin in patents issued the former and developed jointly by them. This process has passed through the laboratory stage and commercial installation is under way. The solution of iron ore is the means of keeping the electrolyte enriched in iron in proportion as it is impoverished by the electrolytic deposition. The electrolyte is ferrous chloride; the anode is of some insoluble material such as graphite; the current density is 50 amperes per sq. ft. The cathode may be a revolving mandrel on which the iron is deposited in the form of a tube, or it may be in the form of a sheet, or a traveling belt from which the crumbs are removed continuously by mechanical means.

The process thus resembles the copper leaching and deposition process so successfully carried out at Ajo,

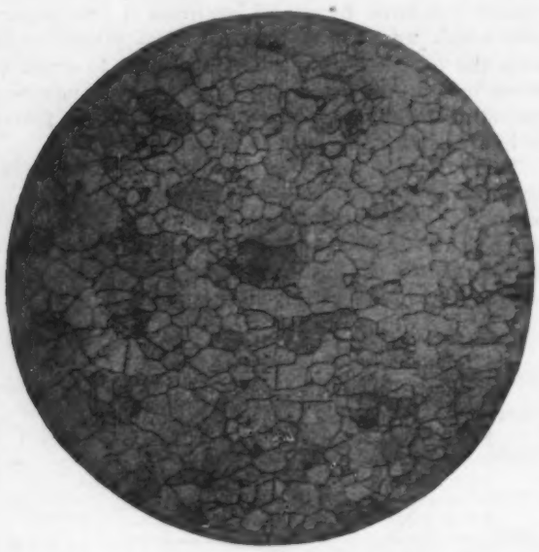


Fig. 5—Photomicrograph of Electrolytic Iron Made by the Eustis Process, 100 Diameters

Arizona, and elsewhere, and the established process of electrolytic zinc production. It faces the necessity of producing a metal which must sell in competition at a price lower than that of copper or zinc, but has the advantage of much lower price for ore and absence of some of the chemical difficulties encountered in the leaching and electrolysis of zinc. It may also be employed in localities where iron ore and a market for iron and steel exist, but where solid fuel for smelting is costly. It differs from the usual "direct process" in that it can deliver a product in finished form, ready for market, instead of a "sponge" which is commercially equivalent to a poor grade of steel scrap and must be submitted to several processes before it has industrial usefulness. It differs from the electric smelting of iron in that it will produce a very pure product without the use of any flux.

Obviously, it can be applied to any iron ore capable of solution, but its cheapest raw material is the abundant sulphide ores which occur in many parts of the world and which sell at a low price, because, first, of their abundance, and second, their inapplicability to blast furnace smelting until after a process of complete roasting. Such ores also yield their sulphur content as a by-product, at a price which more than covers both the cost of sulphur production and the total cost of the ore itself.

Application to Sulphide Ore

The present projected application of the Eustis process is to an iron sulphide ore containing a small amount of copper, and the operations will deliver in marketable form the iron, the sulphur, and the copper in one short series of processes.

Pure iron is deposited on the cathode and the ferric chloride formed in the anode compartment is used over again for leaching, thus making the process cyclical. Sulphur is recovered as brimstone and copper is precipitated out on scrap iron. The speed of leaching depends on the fineness of pulverization of the ore, but presents no difficulties whatever after extended laboratory tests, although it is important to avoid unnecessary use of chlorine by mechanically separating such oxides as lime and magnesia before solution. Leaching is assisted by the circumstance that the reaction is exothermic. Counter current extraction has resulted in delivering 97 per cent of the iron, and 90 per cent of the sulphur content of the ore.

It is unique in metallurgy for one brief cycle of operations to deliver in marketable form more than 90 per cent of any ore. In the electrolytic vats the electrolyte is circulated vigorously, resulting in smooth, compact deposits being obtained; the cathode current efficiency is 90 per cent and over. With proper control no chlorine is lost, or other noxious gases given off. Each step of the process uses standard apparatus which has been developed after years of commercial operation, so that the transition from laboratory to full-scale industrial operation involves no costly experiments. The design of a plant to produce 10 tons of finished tubes per day, using standard apparatus, is shown in Fig. 1.

Purity of Electrolytic Iron

The only serious impurity in electrolytic iron is hydrogen, and this may be entirely removed by baking at a moderate temperature. Traces of other elements may be present by inclusion during deposition, but no great precautions are necessary to produce metal assaying 99.9 per cent and higher. Tubes made at Grenoble and analyzed in America showed 99.97 per cent Fe., and tubes made by the Eustis process assayed 99.99 per cent. It is noteworthy that it costs no more to make the very pure material than to deposit metal of inferior grade, depending upon the process employed.

Mechanical Qualities of Almost Pure Iron

The mechanical qualities of pure iron are greatly affected by heat treatment and cold working; furthermore, the presence of hydrogen, due either to original deposition or to absorption at a red heat—(for some persons, through inexperience, have "annealed" the metal in hydrogen gas and then tested it tensilely)—destroys its strength and renders it both hard and brittle as well. The crystalline structure of the deposited metal is fairly coarse and well defined. It is refined on appropriate annealing, (see Fig. 5), and, on rolling or drawing in the cold state, it takes a beautiful fine structure and brilliant polish, which is more than ordinarily durable on exposure to the atmosphere, dampness, etc. Naturally this refining of the structure is accompanied by increase of strength.

An average of tests made by the National Tube Co. on tubes made at Grenoble, in the condition in which they were received, showed tensile strength in the direction of rolling 62,000 lb. per sq. in., and elongation of 12 per cent in 8 in.; the average of three tests of similar material, redrawn and annealed at 900 deg. C. for 20 min. gave 39,000 lbs. per sq. in. tensile strength and 30 per cent elongation in 8 in. (See tests No. 4 and 6 in the table). The bursting strength of a Grenoble tube 4 in. in diameter and 0.03 in. thick, reported by Escard in the *Génie Civil* article cited above, was 1110 lb., corresponding to a fibre stress of 73,500 lb. per sq. in. It is very probable that pure iron, like very soft steel, would increase greatly in tensile strength

without losing much in ductility by subjection to a double heat treatment.

Table of Tensile Tests of Electrolytic Iron Tubes
(Made at Grenoble, France)
(See also the physical tests in "Characteristic Curve," Fig. 2)

Ultimate Strength, Lb. per Sq. In.	Yield Point, Lb. per Sq. In.	Elongation Per Cent In.		Reduction of Area, Per Cent	
72,600	.....	1.0	2	..	Cold rolled; tested in direction of rolling.*
78,500	.....	8.0	4	..	As received; tested direction of drawing.†
57,800	.....	0.5	2	..	Cold rolled; tested in direction of rolling.*
62,000	52,000	12.0	8	50	As received; average.‡
38,300	.....	0.5	1	..	Cold rolled; tested across direction of rolling.*
39,000	27,000	30.0	8	60	Annealed; average of three results.‡
41,800	.....	35.0	4	..	Annealed; tested in direction of drawing.†

*Tests made at Columbia University.
†Tests made by General Electric Co.
‡Tests made by National Tube Co.

Cold-Working Properties

In *Le Génie Civil* monograph tests are described and photographs given showing the extraordinary softness and cold workability of the Grenoble tubes. Escard says it is the regular practice at Grenoble to draw five times through a die without annealing, as compared with the customary practice with soft steel to anneal before each draft. This statement is corroborated by tests made in America, at the plant of the Stanford Steel Products Co., of iron made at Grenoble and iron made by the Eustis process. Tests of cold rolling, deep stamping after cold rolling and without annealing, cold rolling and beading, threading, etc., showed that the electrolytic iron would undergo work with much less frequent annealing than soft, open-hearth steel, and would endure more cold deformation without cracking than ingot iron, Toncan metal, and, in some instances, electrolytic copper.

This softness and ductility opens a wide field of usefulness, because the saving in cost of annealings alone—(which is an expensive item in cold rolling work)—is an important economic feature, besides the greater ease of working and lessened defective articles. Additional light on the cold-working qualities of pure iron is shown by Fig. 2, "characteristic curve," with which are compared electrolytic copper (Fig. 3) and "Tubing Metal" (Cu 75%; Zn 25%). The latter is given because its qualities so much resemble those of pure iron.

Resistance to Corrosion

A test made at the Massachusetts Institute of Technology by Prof. Carle R. Hayward showed that a piece of Byer's wrought iron pipe corroded nearly twice as much, and Shelby steel tubing 2.6 times as much in the atmosphere as electrolytic iron made by the Eustis process. According to the same authority, an immersion test of 22 hr. in 5 per cent sulphuric acid gave a ratio of loss of weight per unit of area:

For electrolytic iron	1.00
For steel	4.25
For wrought iron	18.50

Magnetic Properties and Electrical Resistance

The superiority of electrolytic iron for some kinds of electromagnets has already been discussed under the head of the electrolytic process of the Western Electric Co. Tests made in the laboratories of the General Electric Co. showed some samples of electrolytic iron gave lower, and some higher, values for permeability and hysteresis loss than the usual standard silicon steel sheets, depending on treatment and source. It seems evident then that the best preparation of this material for magnetic purposes has yet to be found.

Tests made in the electrical engineering laboratories of the Massachusetts Institute of Technology showed that electrolytic iron made by the Eustis process had a specific resistance of 10.0 microhms per cm. cub. at 20 deg. C. This is six times as great as copper, but only 80 to 90 per cent. that of ordinary iron wire. These figures are confirmed by tests made by the General Electric Co. on iron from Grenoble and from other sources.

Fields of Usefulness

There are many articles whose value is dependent more upon their quality, or upon the amount of labor expended on their fashioning, than upon the cost of the material of which they are composed, so that one or two cents more per pound paid for the steel would return, with profit, in the price secured for a superior article, or would be more than made up in saving on labor in fashioning, or saving of defective product. Thus, a softer steel would require less force and less annealing than the grades now available for the manufacture of hundreds of tons of cold rolled and deep stamped articles, such as ware for enamelling; receptacles of various kinds, like oil cans; vacuum bottles; grease cups; thin stamped articles, like buttons; door knobs; shot shell steels; toys, and other thin stamped goods; bodies of automobiles, etc. There are other stamped articles, like the mirror reflectors for headlights, etc., which will not retain perfectly their shape after deep stamping, because of the springiness, or lack of softness or ductility, of the steel; softer electrolytic iron would retain exactly the mathematical form given by the dies.

This advantage would far outweigh the slightly greater cost of pure iron for this purpose. Stamped and beaded articles, like threaded caps, can be made with less annealing and less defective material. The possibility of greater thinness would find its advantage wherever heat conductivity is important, as, for instance, boiler tubes; and even the cook knows that tin cooking utensils bake quicker than aluminum, because they are thinner. The beautiful polish assumed by pure iron after cold rolling, and its resistance to corrosion, may result in cooking utensils being made without tin, and so perhaps avoiding the color which tinned articles assume after heating, and which is the great selling argument for aluminum and nickel utensils.

Thin boiler tubes is a use already mentioned, and involving enormous quantities. Many articles now stamped of copper, because of its softness, could be stamped of electrolytic iron at a greatly reduced price. Where the advantage of increased resistance to corrosion is valuable, there are many uses, such as eaves troughs; boiler tubes (again); pipes and culverts; containers for water and corrosive liquids; parts of automobiles requiring to be bright; ornamental articles to be nickeled and exposed to the weather, where rust soon attacks ordinary steel through its coating and mars its attractiveness; even galvanized, or tinned and painted goods would be more durable if the body of the material were of a less corrosive nature.

Add to this the economic possibility of making electrolytic iron in districts where solid fuel is now too costly for smelting, and we can visualize the commercial advantage of the new industry to localities which already use, or would use, large quantities of articles whose high price is due more to the labor expended on fashioning them than on the cost of the basic material. We are only beginning to secure the information as to the kind and amount of such articles. Where purity

alone is important, we have material like welding wire, for which a fancy price is now paid for relatively pure material. Iron for magnetic purposes has already been mentioned. It is thought that, as greater quantities of pure iron are available for research, investigation will enlarge this field. Electrical conductivity purposes should be included; and, finally, pure material as the basis for the manufacture of high grade, high priced steel for alloy steels, cutting tools, etc.

Electrolytic iron may be produced directly from the electrolytic vat in the form of a tube, suitable for use as a boiler tube; or it may be in the form of a cylinder which can be mechanically slit into strips of any desired width, gage or length in reason. These strips may be the equivalent of strips for cold rolling, or they may be of very thin gage equivalent to partially cold rolled material, or rods for "rounding" and drawing into wire.

The "characteristic curves" of electrolytic iron compared with electrolytic copper shown in Figs. 2 and 3 indicate the use of this material in the form of wire for electrical purposes. It is evident that the wire can be cold rolled so as to have far better tensile properties as transmission lines than electrolytic copper. It will be noted from the previous tests quoted that electrolytic iron has 10 to 20 per cent greater conductivity than steel. It is therefore about the equivalent of copper clad steel; or the electrolytic iron may be copper clad, thus increasing its conductivity by another 20 per cent or so, and leaving it still not so soft and ductile as to have the objectionable stretching qualities of copper in transmission lines.

Pig Iron and Heavy Melting Steel Prices

In Nine-Year Period Iron Ranged from 3.79 to 116.8 Per Cent Higher Than Scrap—Interesting Side-lights on Law of Supply and Demand

BY H. A. KNIGHT

"HEAVY melting steel scrap is more active and higher. Recent prices have been enough below pig iron to increase the use of scrap as against pig iron at open-hearth plants."

The above paragraph is an extract of THE IRON AGE summary of market conditions for Nov. 10, 1921. It suggests a study of prices of heavy melting steel as compared with basic pig iron, both raw materials for the open-hearth furnace. For the purpose of this study, the quotations of these commodities have been investigated for nine years, thereby including the year 1913, when pre-war conditions prevailed.

The most representative basis of comparison is expressed by the percentage by which basic pig iron prices exceed those of heavy melting steel. For the nine-year period (this includes only 10 months of 1921) the price of pig iron exceeded that of scrap by 36.11 per cent on an average. The excess percentage for 1921 is the highest for the period, being 77.40 per cent. For 1920 it was 71.02 per cent; for 1919, 62.35 per cent; in 1918, only 16.18 per cent.

That this differential percentage is approaching the normal figure of 36.11 per cent is indicated by the fact that the percentage has dropped from 106.2 per cent in January, 1921, to 45.5 per cent for December, 1921.

The high water mark of this differential percentage was reached in March, 1919, when pig iron prices were 116.8 per cent higher than scrap; the low water mark was attained in March, 1916, when basic was only 70 cents higher, or 3.79 per cent.

The quotations used are those published weekly in THE IRON AGE, averaged each month. The heavy melting steel prices appear in the Pittsburgh market reports on old material, these prices representing "delivery to consumers' mills in the Pittsburgh and other districts taking the Pittsburgh freight rate." The basic pig iron prices are also quoted in the Pittsburgh market reports, being those prevailing at furnaces in the Mahoning and Shenango valleys. We have added the freight from the valleys to Pittsburgh, which has varied in this period from 90c. to $1.96 a ton, in order that we may get our iron prices upon the same delivered Pittsburgh basis as the heavy melting steel.

Highest Pig Iron Prices

The highest point reached by pig iron was $53.45, the average for July, 1917; the peak in heavy melting steel was touched the month previous, when $41 per gross ton was the average for June. The lowest average for basic was in January, 1914, the price being $13.40; the lowest for scrap was in November, 1914, when the average was $10.

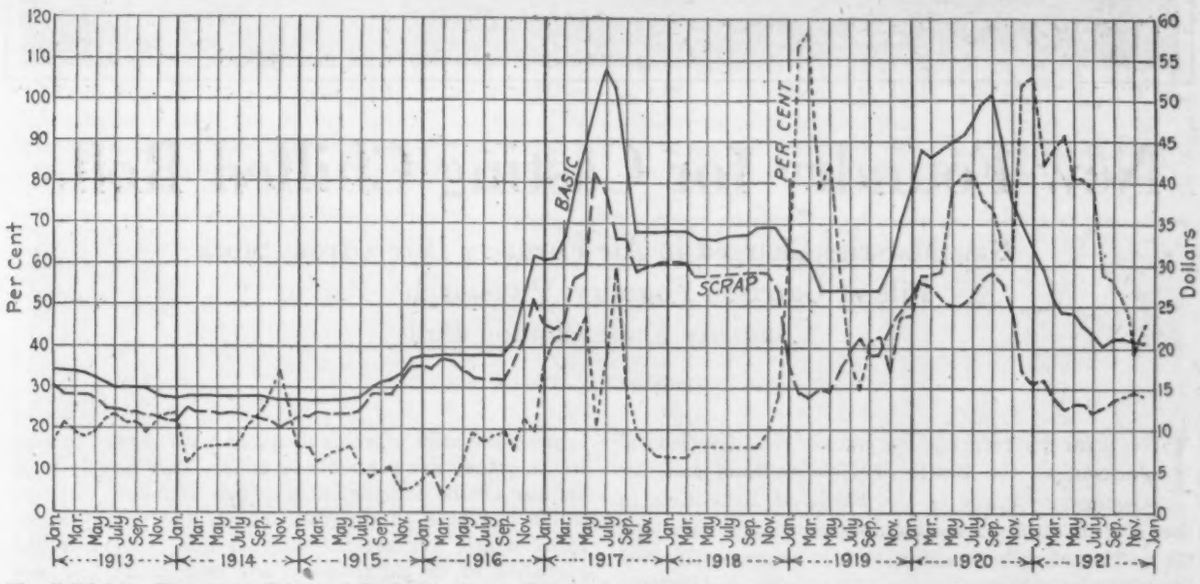
When there was a difference of 116.8 per cent in the price of basic over heavy melting steel in March, 1919, pig iron was selling at $30.34 (monthly average) and scrap at $14. The Government had released control of prices on Jan. 1, 1919. That month the price of $30, Valley furnace, for basic was agreed upon after it had been recommended by the price committee of the American Iron and Steel Institute. On March 21 this price was reduced $4.25 per ton after the conference between the Industrial Board of the Department of Commerce and a special committee representing the iron and steel industry. Business in both pig iron and scrap was very poor during this month. However, the pig iron prices were kept up because of the influence of the official character of these March 21 price fixings. Scrap, however, did not have any official backing, so to speak. THE IRON AGE, reports for March 6 under a Pittsburgh date line read as follows: "Conditions in the scrap trade are no better in any direction and some dealers believe they will be worse before there is any betterment. There is no demand from consumers, whose stocks are heavy. Any scrap disposed of to consumers is by forced sales of material on cars that has to be moved and is sold at the best prices dealers can secure." Mention was made of a large list of scrap issued by the Pennsylvania Railroad, bids on which were lower than had ruled for several years.

Very Little Difference

When there was only a 3.79c per cent difference between prices of basic and heavy melting steel in March, 1916, pig iron prices averaged $19.15 for the month and scrap, $18.45. Again, conditions were unusual. There was a great abundance of iron. THE IRON AGE, for March 9 declared: "Production is now proceeding at the unprecedented rate of 39,500,000 tons a year." Next week it was stated: "There is thus far none of the tension in pig iron that has long been seen in the steel end, nor are there signs of famine conditions." For heavy melting steel, on the other hand, there were both an enormous demand and a great scarcity. In one week the United States Steel Corporation bought 100,000 tons of heavy melting steel for plants in the Chicago and Pittsburgh districts. According to THE IRON AGE report of March 9, "There are many evidences of difficulty of covering short sales, particularly heavy melting steel. For the present a real shortage of scrap exists, as distinguished from the not infrequent apparent shortages of the past." The United States steel

mills were busy during this period with orders for the foreign warring countries. According to THE IRON AGE, of March 2, "Steel prices are rushing up at a furious pace and in the past week conditions have grown more excited."

In July, 1917, instead of the great abundance of pig iron which prevailed in March, 1916, conditions were the reverse and pig iron touched the highest peak of the period, the month's average being $53.45. We reported then: "Sales are light, not because of lack of inquiry, but because iron can't be had. Basic advanced in June over May $7.26, the highest advance in one month in the whole history of the pig iron trade." Basic did not remain on its pedestal long, however,



The Solid Line Represents Prices of Basic Pig Iron. The broken line portrays heavy melting steel. The dotted line shows the percentage difference in price between basic and heavy melting steel. The solid and broken lines are governed by the dollar scale at the right; the dotted line, by the per cent scale at the left

because of railroad embargoes against shipment of American iron abroad, which turned iron, held up at the ports, into resale iron, bringing the market down $3 a ton.

High Price for Heavy Melting

Heavy melting steel reached its high price one month previous, touching $41 for the month's average. Quoting from THE IRON AGE of June 7, "The whole scrap market is very much excited, material of all kinds being scarce and dealers looking for higher prices. They point to the shortage of ore, the increase of open-hearth capacity by 3,000,000 tons in the past year without a corresponding increase in pig iron output." Next week it was stated, "It seems that steel scrap has finally come into its own." Later that month—"The supply of scrap of all kinds available for the market is short of meeting the demand and some dealers are holding scrap for higher prices."

When pig iron reached its low of $13.40, average for the month of January, 1914, the steel industry was in a great depression. Some of the steel mills were starting to resume "after one of the longest and most extensive holiday shutdowns the industry has known." The "million-idle-men" exhibit had been paraded before Congress to call attention to the Government the serious conditions of unemployment.

Heavy melting steel's low mark was reached in the same year, but during November. THE IRON AGE reports said: "There is no inquiry for scrap from consumers and the only trade is between dealers. Operations among open-hearth steel plants have been on so low a basis for some months that the consumption of scrap has been more than cut in half." A later report stated that the mills using scrap were operating at from 35 to 40 per cent capacity.

Effect of High Freights

The use of scrap has been lessened because of freight rates, which are higher on old material than on pig iron. A scrap concern in Chicago has drawn up a chart of freight rates from the principal producing centers of pig iron and scrap to the principal consuming centers. There are 80 hauls tabulated; in four of these the freight rates on iron and scrap are the same; in six, pig iron rates are higher; in the rest, or 70, scrap takes the higher rates. For instance, from Birmingham to Cincinnati, pig iron is favored to the extent of $1.245 per ton, or 28 per cent from Chicago to Moline, the difference is 70c. per ton, or 35 per cent; from Cleveland to Toledo, pig iron is favored 42c. per ton or 17 per cent. At present it is impossible to move scrap any considerable distance because of the high freights. Theoretically, at least, scrap is therefor not in a position to compete so keenly with pig iron, which has lower rates. Lack of competition, then, would tend to keep the prices of pig iron and scrap far apart. Perhaps that is one reason why, in December, 1921, there was still a 45.5 per cent difference.

As "history repeats itself," a study of the past should prove a guide to the future. Valuable lessons should be learned from the fluctuations of the past nine years.

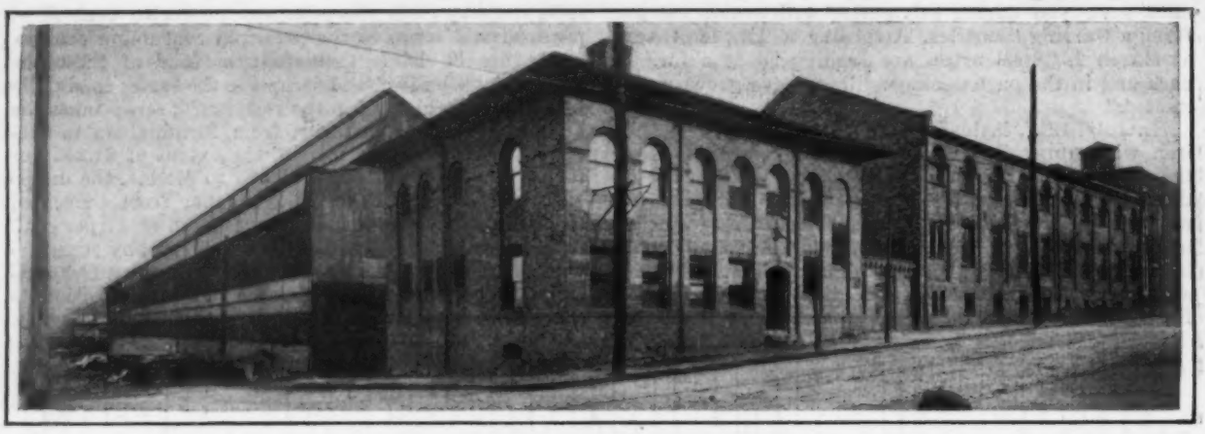
Election of Officers of Allied Machinery Co. of America

The directors of the Allied Machinery Co. of America at a meeting held in New York on Dec. 23 elected the following officers for the ensuing year: J. W. Hook, president; S. T. Henry, vice-president; E. M. Hartridge, vice-president, in charge of business in Europe; T. G. Nee, vice-president, in charge of business in the Orient; W. H. Gilbert, treasurer; Gordon C. Carson, secretary. The directors of the company are the following: J. W. Hook, M. C. Brush, John E. Gardin, T. W. Streeter, H. A. Arthur and Gordon H. Balch.

Purchasing Agents to Have Exposition

The National Association of Purchasing Agents, 1408 Kimball Building, Chicago, has completed plans for its seventh annual convention, May 15 to 20, 1922, at Rochester, N. Y., in conjunction with which there will be an exposition of products of all kinds which its members buy. The exhibit feature, which has been named the "Informashow," will take place at Exposition Park, Rochester, and a large number of exhibit spaces will be provided for manufacturers who desire to take advantage of this opportunity to display their goods before the purchasing agents.

Sheet metal contracting interests at Youngstown, Ohio, have established a course of training for apprentices, classes meeting regularly, in order to solve the problem of the dearth of skilled journeymen.



New Foundry for Casting Chilled Rolls

Raw Material Charged in Air Furnaces Direct from Stock Pile at Garrison Foundry, Pittsburgh—Parent Company Made Cannon Balls

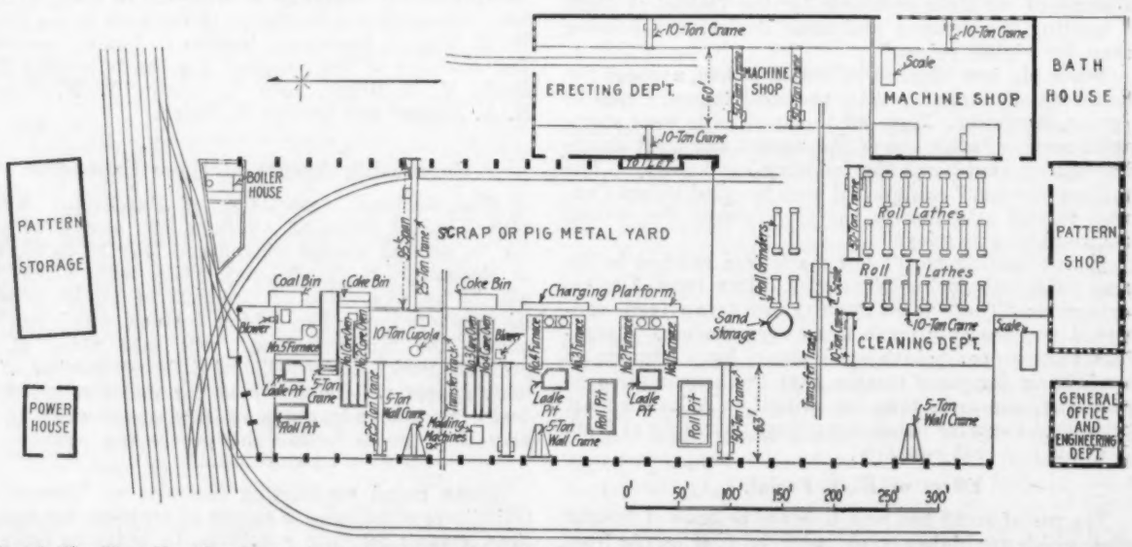
BY GEORGE F. TEGAN

IT is a far cry from casting cannon balls for General Jackson at the Battle of New Orleans and for Commodore Perry in the Battle of Lake Erie in the War of 1812, to the building of rolling mills and the casting of rolls weighing 45 tons or more. In 1803 the company now bearing the name of the A. Garrison Foundry Co. came into existence and it has kept pace with the growth of Pittsburgh. It was the pioneer producer west of the Alleghenies of chilled iron rolls, but did not stop there; for in the development of the present day rolling mills, notably for rolling steel plates, the company played an important part. Hanging in the company's office is a photograph of a 3-high, 24-in. plate mill, which was exhibited and was awarded a grand prize at the Centennial Exposition in Philadelphia in 1876. This was more than 30 years after the company had cast its first chilled iron roll. So long has the company been making rolls and rolling mills that its name has become synonymous with those products. Keeping pace always with the demands for rolling equipment, not only for the finishing of steel but of all other metals which have to be rolled for further manufacture, the company today is equipped to meet the most extreme demands with regard to size, whether they are for mills or rolls. This largely is so because of the completion of a new foundry, work on which has been in progress during the past year or more, which was erected without interruption to the operation of its old foundry, and over which the new one was built.

In the issue of October, 1885, of the *Magazine of Western History*, edited by William W. Williams and published in Cleveland, was a personal sketch of Abraham Garrison, from whom the company takes its name, which we quote:

"The first iron foundry in Pittsburgh, and probably the first west of the Allegheny Mountains, was built in 1803 by Joseph McClurg, Joseph Smith and John Gormley, and was called the Pittsburgh Foundry. It stood on the ground now occupied by the custom house and postoffice,* corner of Fifth Avenue and Smithfield Street, until 1852, when it was removed to its present location on the south side of the Monongahela River, embracing the squares bounded by Ninth and Tenth streets, Bingham Street and the river. On

*Now occupied by the Park Building.



(Above) The New Foundry Is at the Left. The office buildings are at the junction of the two streets; the building housing the pattern shops and pattern and lumber storage are at the right. Below is a plan of the new foundry

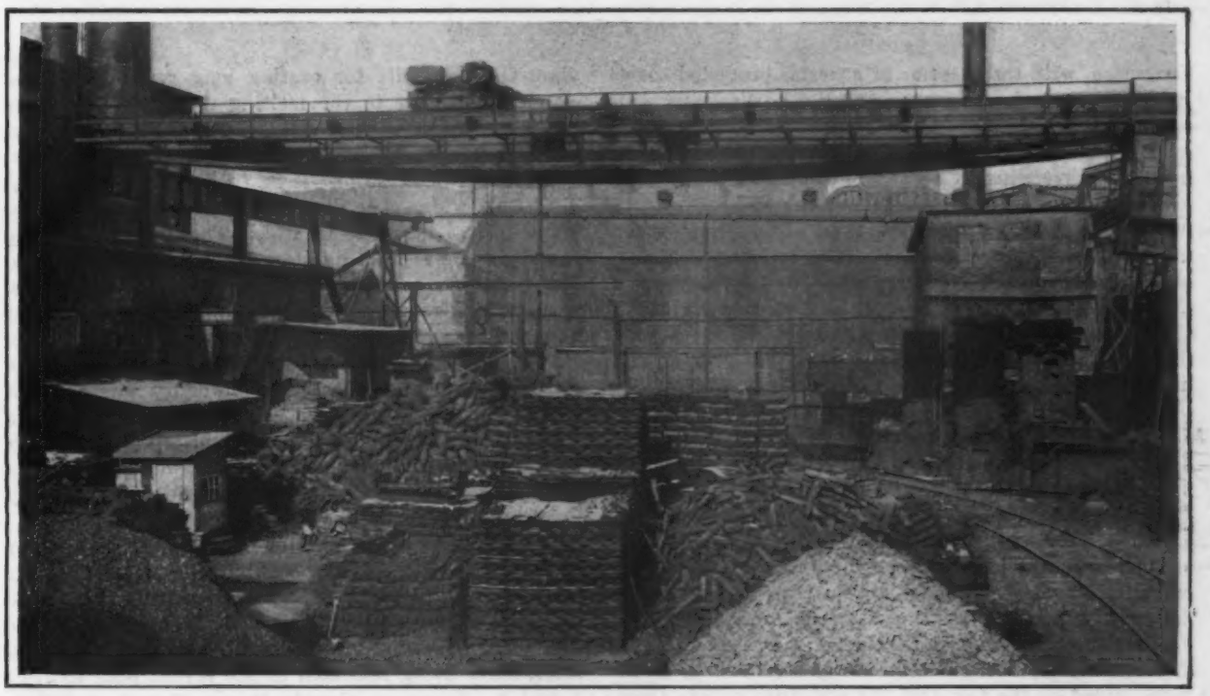
the shelves of its lofts are still to be seen patterns which recall the infinite variety of its former business, and the early history of western Pennsylvania. In 1812 were cast in this foundry the cannon balls which, on the outbreak of the war with England, were sent to New Orleans and used by General Jackson on the memorable eighth of January, 1815. Many of our Pittsburgh readers will remember hearing their parents tell of the time when a dozen wagons were seen waiting, at once, in front of the old foundry for the projectiles to become cool enough to be shipped to Commodore Perry on Lake Erie. After peace was declared, the molten metal was poured into ploughshares instead of cannon balls, and water pipe, hollow ware, threshing machines, castings and stoves took the place of the instruments or war.

"The first chilled roll made west of the mountains, the manufacture of which was destined to become the great specialty of the Pittsburgh Foundry, was cast in 1825 at the Eagle foundry of Kingsland, Lightner & Co. As rolling mills began to be built in western Pennsylvania, the Pittsburgh Foundry was equipped to supply their machinery.

"The Pittsburgh Foundry can boast of fewer changes of ownership during the 82 years (to 1885) of its existence than most establishments of its age in the United States. Shortly after its erection Joseph McClurg bought out his partners, Smith and Gormley, and with his son, Alexander McClurg, conducted the business successfully till 1814. From 1814 to 1822, the foundry was owned and operated by McClurg and McKnight and then by Alexander McClurg & Co. till 1830, when the establishment was purchased by Kingsland, Lightner & Co., proprietors of the Jackson and Eagle foundries, the business of which was merged into that of the Pittsburgh Foundry. From 1831 to 1836, the firm was known as Kingsland, Lightner & Cuddy. In 1836, Abraham Garrison obtained an interest in the business, and in 1840 Mr. Garrison, who was a nephew of Kingsland, and H. L. Bollman, a nephew of Lightner, succeeded their uncles, and associating with them H. F. Bollman, carried on the business under the name of Bollmans & Garrison till 1851, when H. F. Bollman withdrew. From 1851 to 1863 the firm was Bollman & Garrison, and from 1863 to 1865, Bollman, Garrison & Co. In 1864 Mr. Garrison bought Mr. Bollman's interest and the partnership of A. Garrison & Co. was formed Jan. 1, 1865."

The sketch credits Mr. Garrison with having begun, in 1842, to furnish the sheet brass mills of the Naugatuck Valley in Connecticut with chilled rolls, which prior to that time had been imported from England. In passing, it might be stated that today the company is particularly conspicuous as a maker of rolls for mills running on copper and other non-ferrous metals. Besides having helped to capture the home market for chilled rolls for American manufacturers, it is an exporter on a fairly extensive scale both of rolls and mills. Recent shipments of the company were of two 44-in. plate rolls, each weighing 80,000-lb., to Japan; a 34-in. x 100-in. 3-high plate mill and a 42-in. 3-high Universal plate mill to Italy.

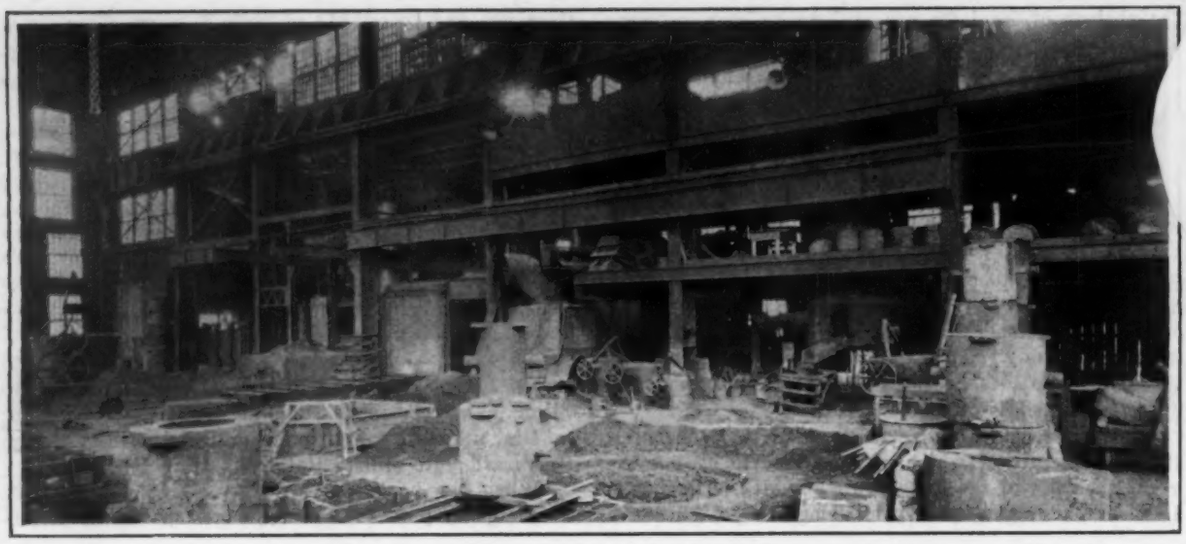
When the health of Mr. Garrison failed in 1862, the company passed to the management of his son-in-law, J. H. Ricketson, who held the presidency until his death in 1900. His son, J. H. Ricketson, Jr., was then elevated to the presidency, and has been active head ever since, except during the period of the world war, when he served as a captain in the 315th United States Infantry in France. The other officers of the company are O. G. Ricketson, vice-president; J. R. Williams, treasurer and general manager, and G. W. Caulkett, secretary and assistant treasurer. The officers of the company also form the board of directors.



A Spur of Track of the Allegheny & South Side Railroad Runs into the Storage Yard. The crane is of 25-ton capacity, with a span of 95 ft. During the war it was necessary to use this yard for erecting mills for shipment to take the load off the machine shop

By the completion of its new foundry the company now possesses the facilities for taking care of demands for mills exceeding in size any now installed, and for rolls of larger diameter and wider face than are now operating. The capacity of the equipment of the old foundry was taxed to the limit in the casting of one roll 42 in. in diameter with a face of 152 in. In the new plant the company has arranged for a pit capacity of four rolls, 44 in. in diameter, also for rolls having a rolling surface up to 210 in. long. Dozens of small rolls can be poured daily.

The new structure, which replaces the one of brick erected in 1852, when the company moved from its original location to its present one, is of all steel con-

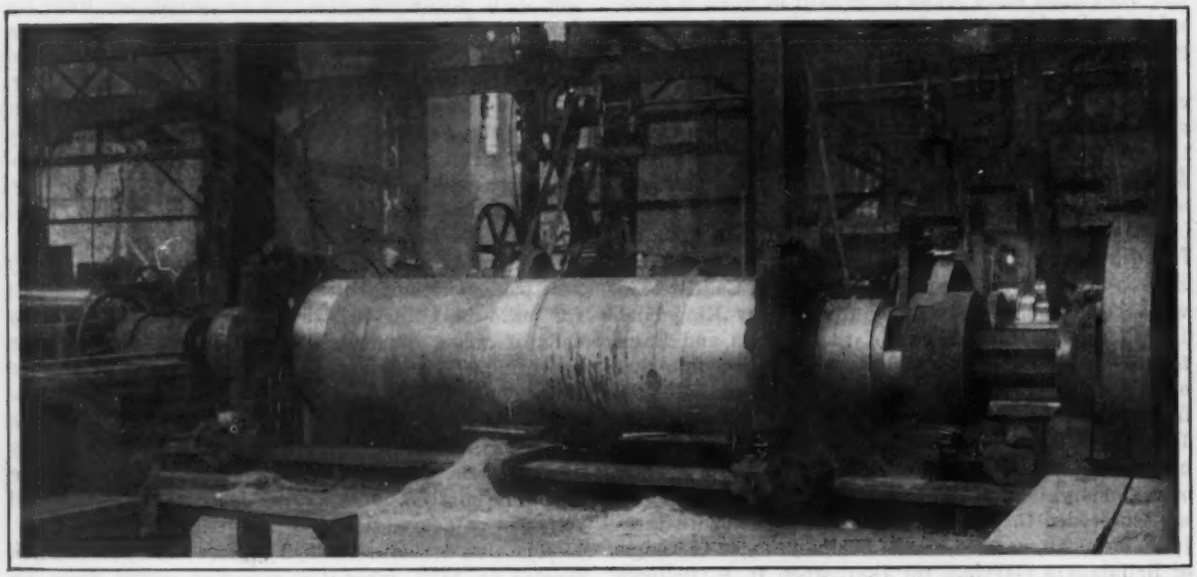


In the Background and at the Right of the Molding Floor Is a Cupola. The core ovens are in the center and at the left is No. 5 furnace and ladle

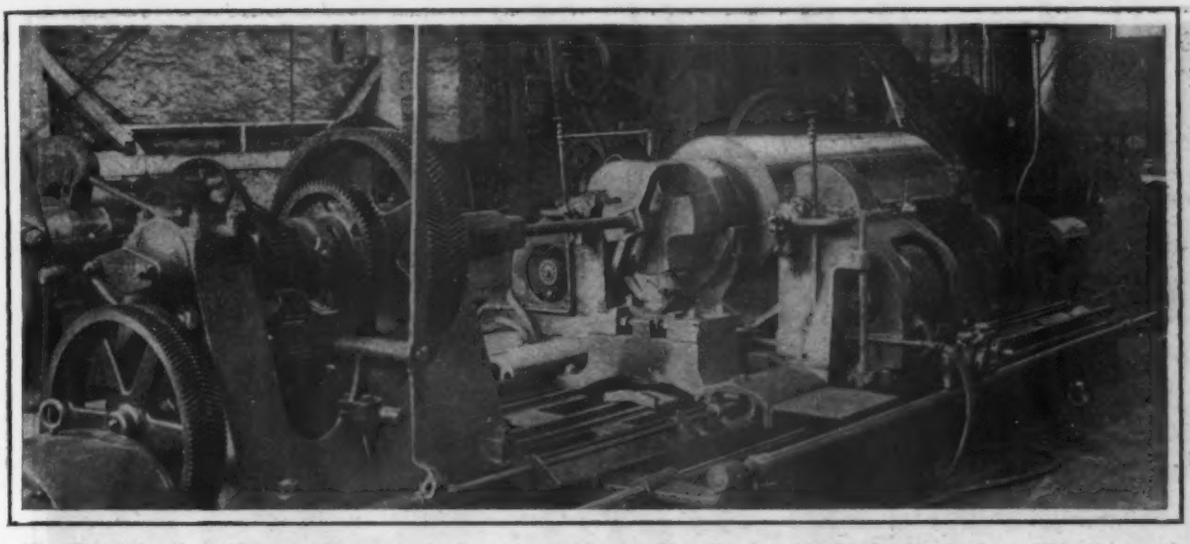
struction, with the exterior of asbestos-protected corrugated sheet steel. The roofs are Pond truss type with operating steel sashes, which assure perfect ventilation and ready egress of mold and furnace gases. These roofs are covered with a gypsum compound, which it is claimed keeps out the heat in summer and the cold in winter, and also obviates the need of painting, while repairs are seldom necessary. The building begins a short distance below Bingham street and extends down Ninth Street in the direction of the Monongahela River, 480 ft. to the tracks of the Allegheny & South Side Railroad, a connecting line with the Pennsylvania and the Pittsburgh & Lake Erie railroads. A spur of the Allegheny & South Side Railroad runs into the yard of the company, which thus has the service of the two trunk lines with which that road connects. The building comprises a main bay, 60 x 480 ft., and a leanto, 30 x 400 ft. The latter has an additional floor at an elevation of 25 ft. The foundry building thus has an effective area of over 40,000 sq. ft. The entire plant, with the foundry and shops, covers several acres. The impressive features of the building are the skillful utilization of this area and the practically perfect lighting achieved by the generous use of steel sashes on all sides, aided by the fact that the structure stands apart from other buildings, and consequently is free of light obstructions.

As will be observed from the accompanying layout plan, the deep pits for casting long rolls are located conveniently near to the melting units and the pouring pits. These casting pits, which go below the level of the bed of the Monongahela River, are water tight. The smaller of these pits is 26 ft. deep and 30 ft. long and 15 ft. wide. The dimensions of the larger casting pit is 40 ft. long by 18 ft. wide. The upper end of the foundry floor is used as storage for chills and flasks. The leanto floor forms an alcove which affords storage space for refractories and other material which must be readily available, and surmounts the furnaces, cupolas and core ovens, which thus are installed off the main foundry floor. In the old foundry was a round casting pit, 15 ft. in diameter and 24 ft. deep, which is located in the leanto of the new plant. It was the first plan of the company to fill in this pit, but later it was decided to use it for a winter storage for sand, thereby keeping it dry.

The melting units already in operation consist of two 15-ton and one 25-ton coal-burning stoker-fired air furnaces and a cupola, with normal capacity of 15,000 lb. of metal per hr. but which, if forced, can produce 20,000 lb. Two more air furnaces are to be installed later, these being indicated in the layout plan as Nos. 1 and 2. Furnaces already in are Nos. 3, 4 and 5. Nos. 1 and 2 are paired, as are Nos. 3 and 4. No. 5 stands at the lower or river end of the building. Besides the feature of stoker-firing, in which the company



A 42-In. x 152-In. Chilled Iron Roll Is Here Being Turned in a Lathe

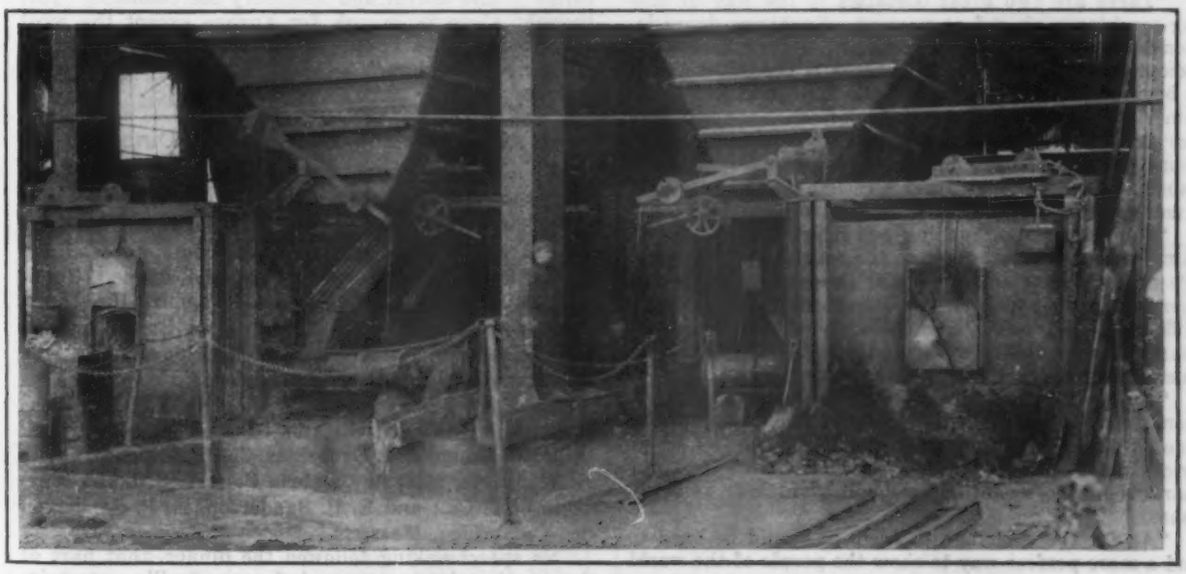


The Fine Smooth Surface, So Necessary in Rolls for Mills for Non-Ferrous Metals, Is Obtained in This Improved Grinder or Polisher. The new type of tool has a completely enclosed headstock

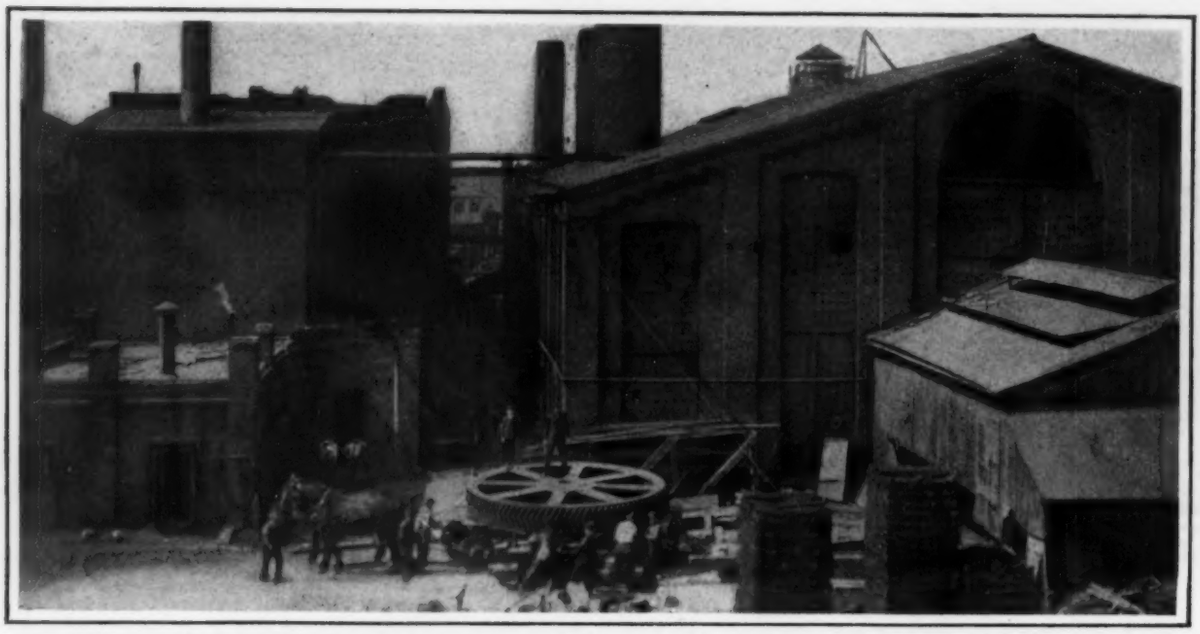
has been a pioneer and claims to have had a good success, is the charging arrangement. As the furnaces back up to the storage yard, pig iron and scrap are charged direct from the stock piles and the labor and handling costs thus are reduced to a minimum. The furnaces, pits and the foundry proper are served by two overhead electric traveling cranes, one of 50 ton capacity and the other of 25 tons, while for handling the flasks for the molders there are three 5-ton wall cranes. Another 50-ton main bay crane is to be installed. The molding floor covers an area of 25,000 sq. ft. An air-operated jarring machine is used to mold medium-sized flasks, while several small machines are used for small work. Compressed air is used for ramming the sand and for chipping. In the cutting off of risers, the company has experimented with gas and electric torches, but without success—at least not for cutting the surplus metal from roll castings, which can be removed only by heavy roll lathes.

A mezzanine floor, independent of the leanto floor and below it at the lower end of the building, contains the motors and blowers for the cupola and air furnaces. This floor and the main one above are steel plate over a concrete base. A 24-ft. elevator at this end of the building, with an opening to the stock yard, lifts coke, pig iron and scrap for charging into the cupola. It also serves a core room and core ovens on the main leanto floor. This floor is to be served by a monorail sytem running its entire length and to extend out to the storage yards, where the company is to construct a coal pocket, etc. Coal is to be conveyed in grab buckets from this storage to the air furnace hoppers opening on this floor. Aside from the coal handling, the monorail system will serve a multitude of purposes, among them being the conveying of coke and metal to the cupolas, the delivery of sand to the large storage pit and the transferring of patterns to the projecting platforms that extend into the main foundry building. The traveling cranes carry the patterns from these projecting platforms and place them on the molding floor.

The machine shop contains no equipment uncommon to a plant of this kind except a 42-in. milling machine with four heads, designed especially to mill bed plates for rolling mills. The machine shop is served by two overhead electric traveling cranes of 25 ton and 50 ton capacity, respectively. The entire plant is practically self-contained for, in addition to the foundry and machine shop mentioned above, the following adjuncts are in use: An extensive laboratory, a large pattern



All of the Air Furnaces Burn Coal and Are Stoker-Fired. Nos. 3 and 4 furnaces, respectively of 15-ton and 25-ton capacity per heat, are shown here. The large coal hoppers appear in the upper part of the picture



The Space Formerly Occupied by the Old Foundry and Stock Yard, Shown Here, Now Contains the New Foundry Building

shop, an immense roll turning and grinding shop, as well as consulting, engineering and designing departments. The thoroughly equipped departments have facilities for turning out mills and rolls from 8-in. in diameter tin foil mills to 44-in. diameter steel plate mills. At one time there could be seen on the erecting floor separate mills for the rolling of aluminum, brass, copper, lead, steel and zinc.

Bad Year for Machinery Exports

But J. W. Hook of Allied Machinery Co. Says its 1921 Business Was 40 Per Cent of That Done in 1920

"EXPORT machinery trade is bad, but whether it is much worse than domestic machinery trade at present is doubtful," said J. W. Hook, president Allied Machinery Co. of America, to a representative of THE IRON AGE. "Our reports for November and December are not all in, but I believe I am safe in saying that my company, which sells only in foreign markets and confines its efforts to American machinery exclusively, booked about 40 per cent as much business in 1921 as in 1920. Japan and France yielded the greatest portion of this volume. Belgium, England and Italy dropped back the most.

"There are two great obstacles in the way of selling machinery abroad at present. Exchange depreciation is one of them and it affects almost the entire world except Japan. German competition is the other and it is beginning to affect seriously the European and South American markets. These obstacles, when coupled with the surplus and distressed stocks of machinery in all countries, and the low buying power of everybody because of the depression, offer a resistance to the sale of American machinery that is indeed formidable.

"I am so tired of reading and hearing about 'conditions' that I've about come to the conclusion that there are none. I have sold goods for the past 18 years and there have always been conditions and obstacles and difficulties and even impossibilities. The thing that counts is one's ability to succeed despite conditions, and this is what we must all steel ourselves to do.

"If German competition is demoralizing for the moment, let us remember that it cannot remain so always. One of these days, not so distressingly far off, their prices must advance and, provided we have held our markets in the meantime, we will give them a merry chase.

"As for the exchange problem, it would be hard to find a more perfect way to show the people of the world the need for more production than by depreciated exchanges. Production is the only natural way to correct exchanges, and production means a demand for machinery as well as for every other essential.

"The thing to do now is to protect our markets by getting a share of the foreign machinery orders even though it may cost us some money to do it. We certainly can afford to spend or lose more money than Germany, and some day those markets across the water will be indispensable to us. I have supreme faith in our foreign markets. I believe the world will demand an increasing amount of the goods we produce. I think this applies particularly to machinery, which is the converter that takes raw and worthless material and transforms it into useful and necessary merchandise. This thought alone is enough for anyone except the most confirmed skeptic. Suppose we forget about conditions and go after orders."

New England Iron League Dinner

Approximately 70 persons attended the 1921 annual dinner of the New England Iron League, which was held Thursday evening, Dec. 29, at the Boston Athletic Association. It was one of the most entertaining annual affairs ever before held by the league. Credit is due Charles H. Carter, Midvale-Cambria Co., chairman; Harold L. Stevens, Lackawanna Steel Co.; and John G. Andrews, president Boston Bridge Works, who constituted the dinner and entertainment committee.

Among those who sat at table with R. B. Wallace, Bethlehem Steel Co., dictator of the league, were M. Congdon, Congdon & Carpenter Co., Providence, R. I.; H. W. Hayes, Midvale-Cambria Co.; W. S. Locke, Carnegie Steel Co.; and E. P. Sanderson, E. P. Sanderson Co., Cambridge, Mass.

No speechmaking followed the dinner, that part of the evening being reserved for vaudeville entertainment and moving pictures.

Production and Yield of Rolling Mills

Their Present State of Development—Some Useful Operating Data—Losses Which Should Be Lessened —European Practice Leads in Yield

BY JOSEPH F. SHADGEN*

THE acute reaction and severe setback now affecting the whole business world have brought into the limelight the overshadowing importance of low cost of production in every branch of industry. Sudden or progressive reductions of selling prices, constantly shrinking margins of profit, have forcibly drawn the attention of all interested to the various factors that make up the cost of production. Economy has become the watchword in every enterprise, and efficiency the remedy, for salvation.

The iron and steel industry did not escape this universal readjustment, and had to carry a heavy burden during the shifting of economic conditions. Yet it is remarkable to notice the complete absence of discussion, even of reference, in the trade press, to the actual difficulties confronting the managers of the various plants. While selling prices are mentioned everywhere, the problem of production costs is rarely mentioned, although the close relation that links the two is obvious. No industry can neglect the one without detriment to the other.

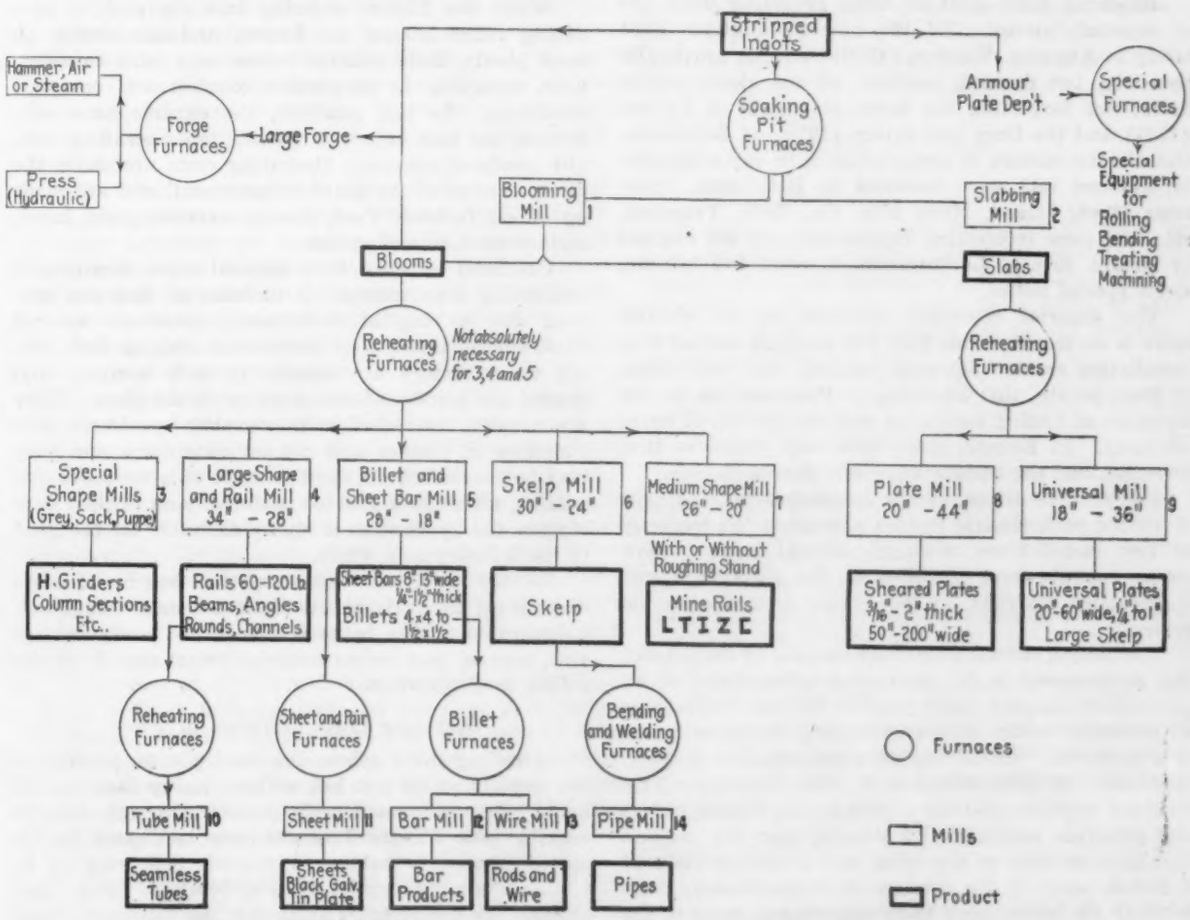
In the light of present experience, the extravagance of recent years is bitterly paid for by many enterprises not prepared for the unprecedented slump in production. A detailed study of the cost of production seems therefore most timely in order to show the relative values of the various component factors, and to enable the individual operator to compare his results with the general averages obtained elsewhere. These lines, in attempting to present these results from the modern rolling mill, represent an effort to fill a long-felt gap in technical literature. Far from being didactic, the analysis presented should form the basis of a discussion for the common good of the entire industry. Criticism therefore will be welcome as a co-operative reaction of the reader's mind. The author's attitude is clearly reflected by the French proverb: "Du choc des idées jaillit la lumière."†

While the practical application of the rolling mill process is the outgrowth of a century of experience, standardization is the main feature of the art today. The period of development may be considered past, and no startling novelties are to be expected. But we have ahead of us a period of crystallization characterized by the study of details, of problems of which the proper sequence of grooving of the rolls is the most important.

Starting from the ingots cast in the steel plant, the sections are progressively reduced on various rolling mills built especially for each purpose, and equipped with accessories that permit quick handling in large tonnages. The accompanying chart is a flow sheet of the modern rolling mill, showing the accepted spe-

*Consulting engineer, New York.

†From the clash of ideas springs the light.


Stripped Ingots
Hammer, Air or Steam
Press (Hydraulic)
Forge Furnaces
Large Forge
Soaking Pit Furnaces
Armour Plate Dep't.
Special Furnaces
Special Equipment for Rolling Bending Treating Machining
Blooming Mill 1
Slabbing Mill 2
Blooms
Slabs
Reheating Furnaces
Not absolutely necessary for 3,4 and 5
Reheating Furnaces
Special Shape Mills (Grey, Sack, Puppe) 3
Large Shape and Rail Mill 34" - 28" 4
Billet and Sheet Bar Mill 28" - 18" 5
Skelp Mill 30" - 24" 6
Medium Shape Mill 26" - 20" 7
With or Without Roughing Stand
Plate Mill 20" - 44" 8
Universal Mill 18" - 36" 9
H-Girders Column Sections Etc..
Rails 60-120 Lb Beams, Angles Rounds, Channels
Sheet Bars 8" - 13" wide 1/4" - 1 1/2" thick
Billets 4 x 4 to 1 1/2 x 1 1/2
Skelp
Mine Rails
Sheared Plates 3/16" - 2" thick 50" - 200" wide
Universal Plates 20" - 60" wide, 1/4" to 1" Large Skelp
Reheating Furnaces
Sheet and Pair Furnaces
Billet Furnaces
Bending and Welding Furnaces
Tube Mill 10
Sheet Mill 11
Bar Mill 12
Wire Mill 13
Pipe Mill 14
Seamless Tubes
Sheets Black, Galv. Tin Plate
Bar Products
Rods and Wire
Pipes
Furnaces
Mills
Product

Flow Sheet Showing Progress of Steel from the Ingot to Final Product

cialization of the industry of today. Recent descriptions of modern installations are familiar to the readers of THE IRON AGE, which can be usefully consulted in conjunction with this study. Special reference is made to:

Plate and Structural Mills at Fairfield, Ala., Jan. 2, 1919, page 47.

Steel Plant and Rolling Mills of the Weirton Steel Co., March 16, 1921, page 619; March 17, page 693.

Steel Plant and Rolling Equipment of the Inland Steel Co., July 10, 1919, page 91; July 17, page 155.

Brier Hill Steel Co.'s Plate Mill, Dec. 19, 1918, page 1521.

Mark Mfg. Co., Universal Plate Mill, July 11, 1918, page 65.

Flexibility of Output Assured in Scullin Mills, March 31, 1921, page 829.

Rerolling Rails at Sweets Steel Co., May 12, 1921, page 1227.

Future of To-day's Developments

The practically universal application of electricity as motive power for cranes and the majority of auxiliaries, and for lighting, places its economic superiority beyond the shadow of doubt. For main mill drives, opinions vary between reciprocating steam engines and electric motors, with a decided leaning toward the electric medium. Generalities on this detail problem are not only futile but deceptive; individual study of local conditions, only can do justice to the problem. Technical literature is full of the controversy of motor versus steam engine, and there is still keen competition between these two prime movers. But it is precisely this struggle for supremacy which is responsible for the great progress and improvements realized in the last fifteen years. Electricity has won in most fields, but has found in the steam engine (especially of the uniflow type) a stubborn competitor, able to hold its own under certain circumstances, and we are not yet at the end of the story.

Blooming mills built as large reversing units are of especial interest. Of the new installations built lately in America, Weirton (1920) remains practically the only, but decided, partisan of the steam engine drive; not forgetting the large plate mill of Lukens (1917) and the Grey mill drives (1915) of Bethlehem. But electric motors in conjunction with motor-generator-flywheel sets were installed in Bethlehem, Sparrows Point, Inland, Mark Mfg. Co., Tata, Trumbull, etc., and some interesting replacements of old engines by motors, such as Lackawanna, Steelton and Atlanta, merit special notice.

The superior economic operation of the electric drive is an incontestable fact, but the high cost of first installation creates financial burdens that counteract, at least partly, this advantage. Progress lies in the direction of finding less costly electric devices, of equal efficiency. In Europe, steps have been taken in that direction, and the results will merit close watching.

For smaller drives, of the continuous-running type of rolling mill, electric motors prevail in the majority of new installations, although several large uniflow steam engines were installed in the Pittsburgh and Youngstown districts, on new mills or replacing old drives.

The second outstanding characteristic of the present day development is the increasing automaticity of all auxiliaries (largely made possible by the adaptability of individual motor drives) reducing the labor factor to a minimum. On all big mills manual skill is really superseded by mechanisms of marked dexterity. This tendency explains also the supremacy of the continuous mill principle, originated by Morgan, over the odd and ingenious solution of the billet and sheet bar mills of a decade ago. If the tonnage is large enough, there is today no doubt about their advantages; even in the European plants, where lower production tonnages prevail, continuous roughing mills have gained favor, in combination installations, with two or three finishing trains.

Reversible Versus Continuous Running

Actual comparisons of costs of production showed the desirability of greater specialization of the blooming mill; this was done by narrowing the range of its finished product. While in 1900 a 20 sq. in. section was commonly rolled on reversing mills, in 1910 the standard bloom section averaged 35 sq. in., and today it has reached 60 sq. in. In other words, while in 1910, 4 x 4-in. billets were produced on blooming mills, today's experience teaches that the most economical bloom sections are 8 x 8 in. or 8 x 7 in., and all recent large installations have been laid out accordingly.

This means that the large mills of the reversible type have proved to be the most economical for roughing down ingots of short length, on account of the slow speed of rolling, quick gripping of the material and because of the elastic adaptability of the modern reversing drives to create, at will, conditions best suited for superior results. Modern blooming mills are therefore extremely powerful—for example, the Inland or Sparrows Point installations, which are fed by large ingots that are knocked down into blooms or slabs in tonnages over 50,000 monthly (600,000 tons per year).

Accumulated experience of modern reversing drives, adapted with great success to universal plate mills, has created new standards of operating economy and new records in quantity production. Further immediate developments in the plate mill field will be handicapped by the extraordinary expansion (rather overexpansion) caused by the war necessities and the shipping policy —conditions that will practically prevent new construction in that particular field for some years to come.

Cost of Production

While the factors entering into the cost of producing rolled shapes are known, and are similar in most plants, their relative values may vary considerably, according to geographic location and economic conditions. In last analysis, the experts have subdivided the cost into two items: (a) operating cost, (b) overhead expense. Operating costs are under the direct control of the plant management, and are made up of six factors: Fuel, power, material yield, labor, maintenance, miscellaneous.

Overhead expense is a general term familiar to accounting departments. It includes all financial burdens due to capital investment, insurance against obsolescence, interest on investment, sinking fuds, etc. All these factors are specific to each compay, and beyond the horizon of the operator of the plant. They are closely connected with taxation problems and questions of finance and market conditions, and they may be considered outside the scope of a technical discussion, although a greater uniformity as to their conception and application is highly desirable for the good of the industry as a whole.

To the practical operator, the tangible factors making up his various cost items are most important. Comparable figures between plants are easily obtainable, because they reflect material things specific to the rolling mill operation.

Operating Costs in Terms of Fuel

If rolling mills adjoin the steel plants, the ingots are usually rolled out hot without losing their initial heat. This is economically possible through modern soaking pits. These furnaces may be heated by an outside source to balance a possible deficiency of B. t. u., or simply consist in well-insulated holes that equalize the temperature balance of the freshly stripped ingots. Reheating furnaces are built for blooms, slabs,

billets and rods, and use fuel in the form of coal on grates or stokers, producer gas, oil, powdered coal, coke oven gas or natural gas.

To heat 100 lb. of iron or steel to 2300 deg. Fahr. rolling temperature, roughly 40,000 B. t. u. are required, equivalent to about 3 lb. of coal of 13,500 B. t. u. per lb., or 0.27 gal. of oil of 150,000 B. t. u. per gal, or 80 cu. ft. of coke oven gas of 500 B. t. u. per cu. ft. or 300 cu. ft. of producer gas at 135 B. t. u. per cu. ft.

Most of the soaking pits in America are of the heated regenerative type, and use either rich or lean gas. Under careful operation they should use not more than 2 to 3 lb. of coal per 100 lb. of steel heated, including the fuel needed during Sunday, when the furnaces have to be kept hot. The soaking time, varying with the ingot section, averages 1 to 2 hr. when hot ingots are fed, and 2 to 3 hr. when cold ingots are handled.

Reheating furnaces are built either in the form of regenerative side-door furnaces for slabs, large blooms, etc., or continuous heating furnaces (pushing type) for blooms and billets. Regenerative reheating furnaces have recorded 9 to 11 lb. of coal per 100 lb. of steel blooms or slabs, and modern continuous furnaces should easily better this performance, with proper flame control.

Billet furnaces built to reheat 1¾-in. billets, 30 ft. long, for continuous mills, have averaged 5 to 6 lb. of coal per 100 lb. of steel, in spite of the transformation loss in the gas producer, and reached a production of 200 tons in 12 hr. Continuous annealing furnaces have been built to consume less than 7 lb. of coal per 100 lb. of steel, and have attained 6.25 lb. as a monthly average (producer gas fired).

Sheet mills, with their various reheating operations and annealing, should not require over 22 lb. of coal per 100 lb. of sheet bars, as some well managed plants have averaged 15 to 18 lb. over long periods. These figures can easily be bettered with proper care, and the application of recent progress in heating science and the present slump in production should be used for improvements in that respect, to stop the great waste of heat, and take advantage of the economies of modern devices. Here is the greatest field of endeavor for the alert operator to reduce his costs.

The achievements above quoted will certainly lead to some searching comparisons. With natural gas still greater economies are possible, but they have seldom been attained, as no refinements existed in the past era of low fuel cost; but the hard necessities of today will forcefully bring these problems into prominence.

Special attention should be drawn here to the importance of proper temperature of the steel to be rolled. The highest steel temperature compatible with the quality of the material should be used, as the classic investigation of Puppe has shown that 1 kilogrammeter displaces at 1300 deg. C., 90 ccm.; at 1200 deg., 45 ccm.; at 1100 deg., 30 ccm.; at 950 deg., only 20 ccm.; a reduction of 78 per cent in a 350 deg. drop of temperature.* The influence of proper heating appliances on power costs is therefore conclusively demonstrated, and it is unfortunate that these data have not received adequate attention and consisent application every day in the shop or mill.

The cost of fuel is not only the value of the coal consumed; it includes also the handling and transformation charges of the heat into the form of ultimate utilization, which usually involves labor, power and maintenance, as in the case of a producer house or a pulverization station. Besides that, gasification, including the loss of heat, brings a total charge of 60c. or $1 per ton of coal, according to local conditions, while pulverization will be taken care of by a surplus of 30 to 70c. per ton, varying with the size of the plant. Modern oil installations are practically automatic in their operation, and necessitate very little overcharge, while the rich gases are delivered at such pressures that practically no additional cost is involved.

In large rolling mill installations, working a sequence of trains, the ingots may be rolled in one heat down to 1¾ x 1¾ in., or 8 x ⅜ in., if continuous mills are used in conjunction with the blooming mill, but it is not safe to figure on that performance. Shapes down to 3 or 4 sq. in. cross section (10 to 14 lb. per ft.) are also rolled in one heat, although it is customary to figure on reheating, intermediately, about one-third or one-fourth of the tonnage. Smaller shapes and bars are made from blooms or billets that are all reheated. In Europe the tendency is to standardize on 4 x 4 and 6 x 6 in. billets up to 6 ft. long, and reheating furnaces of the continuous type are commonly built for those sections. Figures for oxidation, covering various plants over years of operation, are given later.

Power Consumption in Rolling

The importance of the power cost cannot be overestimated; to give simple and comparable figures only electrical drives are considered, and only the number of kilowatt-hours per ton rolled are given, as it is impossible to go into specific details in a perspective study.

1.—Large blooming mill, with 36 to 40-in. pinion diameter, driven by 5000-hp. motors, under Ilgner system control, guaranteed to roll 45,000 to 60,000 tons of ingots monthly (24 x 24 in. of 9100 lb. and 28 x 39 in. of 18,000 lb.) to 8 to 12 elongations, average 10; and standard bloom 8 x 8 in.

Average main drive per ton of ingots	16 kwhr.
All auxiliaries plus cranes plus shear	4 kwhr.
Total per ton of ingots	20 kwhr.

2.—Medium size blooming mill, with 30 to 35-in. pinion diameter, driven by 4000-hp. motors, Ilgner system, guaranteed to roll from 30,000 to 45,000 tons of ingots monthly (20 x 22 in. of 6800 lb. and 25 x 25 in. of 11,500 lb.) to 10 to 18 elongations, average 14, and standard bloom 6 x 6 in.

Average main drive per ton of ingots	20 kwhr.
Auxiliaries	6 kwhr.
Total per ton of ingots	26 kwhr.

3.—Small blooming mill (roughing or billet mill) with 24 to 30-in. pinions, driven by 3000-hp. motors, Ilgner system, guaranteed to roll 20,000 to 30,000 tons of ingots or blooms per month (18 x 20 in. of 5500 lb. or 12 x 12 in.); elongations 12 to 25; average 20; standard output, 4 x 4 in.

Average main drive per ton of ingots	25 kwhr.
Auxiliaries	8 kwhr.
Total per ton of ingots	33 kwhr.

4.—Large shape mill (continuous running, three-high type in America; reversing two-high type, in Europe), 30 to 60 tons per hr. according to layout; rolling rails, beams, etc., from blooms 8 x 8 in. to 12 x 12 in. or larger; roll diameter, 28 to 34 in.

Rails, average of mill, per ton of blooms	35 kwhr.
Beams, shapes, etc., per ton	40 kwhr.
Auxiliaries	8 kwhr.
Total for rails	43 to 45 kwhr.
Total for beams, etc.	48 to 50 kwhr.

5.—Large plate mill, 110 in. and upward, two-high or three-high, large tonnage, 15,000 tons or more per month, well equipped and with sufficient furnaces and large cooling beds.

Main drive, per ton of slabs	20 to 25 kwhr.
Auxiliaries	15 to 20 kwhr.
Total per ton of slabs	35 to 45 kwhr.

6.—Small plate mill (either three-high or two-high

*An effort represented by 7¼ ft. lb., on steel at 2375 deg. Fahr., displaces 5.5 cu. in.; at 2200 deg Fahr., 2.75 cu. in.; at 2015 deg. Fahr., 1.83 cu. in.; at 1750 deg. Fahr., only 1.22 cu. in.

universal), 12,000 to 20,000 tons per month; good auxiliaries.

Main drive, per ton of slabs	25 to 35 kwhr.
Auxiliaries	20 to 25 kwhr.
Total per ton of slabs	40 to 60 kwhr.

7.—Continuous Morgan mill 4 stands, 21 in. and 6 stands, 18 in.), 15,000 to 20,000 tons per month; one or two separate motors; taking 7 x 7-in. or 6 x 8-in. material and producing 1¾ x 1¾-in. billets or 8 x ⅜-in. sheet bar.

Roll drive, per ton of blooms	20 to 22 kwhr.
Auxiliaries	2 to 4 kwhr.
Total per ton of blooms	22 to 26 kwhr.

8.—Billet mill or medium shape mill (rolls 18 in. to 24 in., one to four stands).

4 x 4 in. to 1¾ x 1¾ (10,000 tons monthly), per ton of blooms	26 kwhr.
4 x 4 in. or 7½ x 4¾ in. to shapes (6000 tons monthly)	55 kwhr.
10 x 10 in. to 4 x 4 in. (6000 tons monthly)	38 kwhr.
7 x 6 in. to 7 x ¾ in. sheet bars	44 kwhr.
Auxiliaries	10 to 20 kwhr.
Total per ton of blooms	35 to 60 kwhr.

9.—Bar and rod mills less than 18 in. in diameter:

(a) Belgian mill, 4 stands of 16-in. and 3 of 12-in., 1 drive, monthly average 6000 tons; maximum billet, 5 x 5 in.

Main drive	60 kwhr.
Auxiliaries	15 kwhr.
Total	75 kwhr.

(b) 10-in. continuous mill; 6 passes; 5000 tons monthly; 1¾ x 1¾ in. to 0.5 x 0.5 in. or 0.4 x 0.4 in.

Main drive	54 to 56 kwhr.
Auxiliaries	2 to 5 kwhr.
Total	56 to 61 kwhr.

(c) Rod mill, 10 passes continuous, 6 on Belgian stands; No. 5 rod; 5000 to 6000 tons per month.

Main drive	100 kwhr.
Auxiliaries	15 kwhr.
Total	115 kwhr.

(d) Bar mill, two continuous stands, three finishing trains; 5 x 5 in. to all kinds of finished sections; 5000 to 8000 tons per month.

Mill drives, per ton of billets	100 kwhr.
Auxiliaries	12 kwhr.
Total	112 kwhr.

Determined by tests:

180 to 67 sq. mm. (28 to 10½ sq. in.), per ton	23 kwhr.
67 to 20 sq. mm. (10½ to 3.15 sq. in.)	37 kwhr.
20 to 14 sq. mm. (3.15 to 2.2 sq. in.)	58 kwhr.

(e) Wire mill, continuous type all through; 1¾ in. to No. 5 rods.

Mill drives, per ton	120 kwhr.
Auxiliaries	8 kwhr.
Total	128 kwhr.

10.—Sheet mills (24 to 30 in. diameter, 6 to 10 stands; 30 x 7 x ¾ in. to sheets of 0.01 to 0.09 in. in thickness).

Mill drives, per ton of sheet bars	105 to 125 kwhr.
Auxiliaries	10 to 12 kwhr.
Total	115 to 137 kwhr.

These data can be substantiated by numerous concrete figures in international technical literature. As a year's average, certain plants show an energy consumption of 175 kwhr. per ton of ingots in reducing from ingots to wire, and below 200 kwhr. per ton of finished product. The figures covered the tonnage rolled and not the amount of finished product, for reasons yet to be discussed.

The net power cost includes, of course, a further amount for labor, material, etc., but the power as represented by the electric energy makes up over 85 per cent, and usually 90 per cent, of the whole item, as shown by figures of numerous mills over years of operation.

(To be concluded)

CAR ORDERS AT LOW POINT

Total for 1921 Was 20,667—Locomotive Buying Also at Minimum

Figures compiled by the *Railway Age* show that additions to rolling stock represented in orders placed in 1921 were the smallest since these statistics began to be kept. Only 20,667 freight cars were ordered last year. The smallest previous number was in 1919, when it was 25,899. During the five-year period ending with 1917 the number of freight cars averaged 108,000 a year, or more than five times the 1921 number. Freight cars actually built for all railroads in the United States in 1921 were 40,354, the smallest number before this year being 60,955 in 1920.

In 1921 only 241 new locomotives were ordered for domestic service, the smallest previous number being 272 in 1919. The number of locomotives ordered in the five years ending with 1917 was considered small at the time, but it averaged about 2,400 a year, or ten times as much as the orders placed in 1921. Locomotives actually built in 1921 numbered 1,121, the smallest number built in any year since 1897.

During the year railroad mileage declined about 1,200 miles. About 475 miles of new track was built, the smallest known except in 1920, when it was 314 miles. Mileage abandoned during the twelve months was 1678 miles, the largest ever known. The net decrease of 1200 miles of track is the largest on record. In the five years between 1917 and 1921 more than 5700 miles of road have been abandoned, while only 3200 miles have been built, making a net decline in trackage in five years of 2500 miles.

Better Business Expected in Valley

Youngstown, Jan. 3.—While buying is inactive for the moment in the Mahoning Valley, makers generally are hopeful that the first quarter will develop considerable new tonnage in the aggregate. Business in January is expected to be somewhat sporadic, in the opinion of a leading sales executive, who looks, however, for some betterment commencing with Feb. 1. Improved buying is expected to be particularly felt in the lighter steel products, such as sheets, tinplate, plates, strips, bars and angles. Sustained demand for such products from the automobile industry is anticipated, in view of the fact that many warehouses in the Detroit district have largely depleted and unbalanced stocks.

Inquiries from larger jobbing interests are making their appearance, and buying from this source is expected to produce considerable tonnage during the next few months. Price unsettlements have acted as a retardant, but there is a more determined effort on the part of producers to stabilize the market. Efforts in this respect have been temporarily successful, at least, in the sheet market. Gross volume of sheet buying in the first quarter is likely to be less than during the last quarter of 1921, and it is unlikely that schedules in this branch of the industry will swing back to the 80 per cent mark reached last October, until in the spring. One of the leading interests, which has consistently maintained normal production in its sheet department, is now curtailing; another is operating its (preponderant) sheets capacity, in negligible volume.

Though basic pig iron was recently sold in the Valley at $18.25, steelworks interests are endeavoring to establish a minimum market of $19. Merchant furnaces are largely out of blast. Open-hearth sheet bars are stabilized at $30. Valley makers are holding plate prices to a 1.50c minimum, but have been at a disadvantage with producers in Eastern territory owing to certain freight rate inequalities. Strip steel business is being accepted on the basis of 2c for hot strip and 3.75c for cold rolled. Tin plate is firmly maintained at $4.75, for the time being, but a lower price on long-time contracts is not considered unlikely. The leading independent maker of wire products is quoting the new prices recently announced by the leading interests, of $38 for wire rods, $2.25 for plain wire per 100 lb. and $2.50 for nails per base keg.

Steel Plant Installed for Sheet Mill

Mansfield Sheet & Tin Plate Company's New Steel Unit Provides Sheet Bars from Bottom-Poured Open-Hearth Ingots

BY CARL W. PEIRCE*

ABOUT seven years ago the old National Rolling Mills Co., at Mansfield, Ohio, was taken over by W. H. Davey and his seven brothers, all practical sheet mill men. The plant was remodeled, and in two months was engaged in the manufacture of steel sheets under the name of the Mansfield Sheet & Tin Plate Co. The old plant, which consisted of three hot mills, housed in a building 67x140 ft., had operated only for a few months.

From time to time, additions have been made to the old plant, so that to-day the building is 167 ft. wide by 940 ft. long, and houses seven tin mills with their accompanying equipment.

Early in 1917 ground was broken for a new sheet mill unit, which is located south of the old plant and on the other side of the Pennsylvania Railroad tracks, between the railroad and Bowman Street. This plant, mainly for the manufacture of high polished sheets, was designed and built under the supervision of Austin Davey, chief engineer of the company. The building, which houses twelve sheet mills with their pickling, annealing and cold roll departments, is 226 ft. wide by 1039 ft. long. This plant was put into operation in the fall of 1919.

On account of its inability to get a satisfactory delivery of sheet bars, the company in the fall of 1919 began to consider the advisability of building its own steel making unit. A piece of land lying between the Baltimore & Ohio and Pennsylvania railroads, and adjoining the company's property, was occupied by two hills which it was necessary to remove. This site was selected on account of its railroad connections and its proximity to the other two parts of the plant.

In March, 1920, the Fred R. Jones Construction Co. started to prepare the site for a steel unit large enough to produce what bars the sheet and tin mills would consume, and the work of designing the unit was begun. This work was done by F. A. Davey, chief engineer, with Frank I. Ellis, Pittsburgh, as consulting engineer.

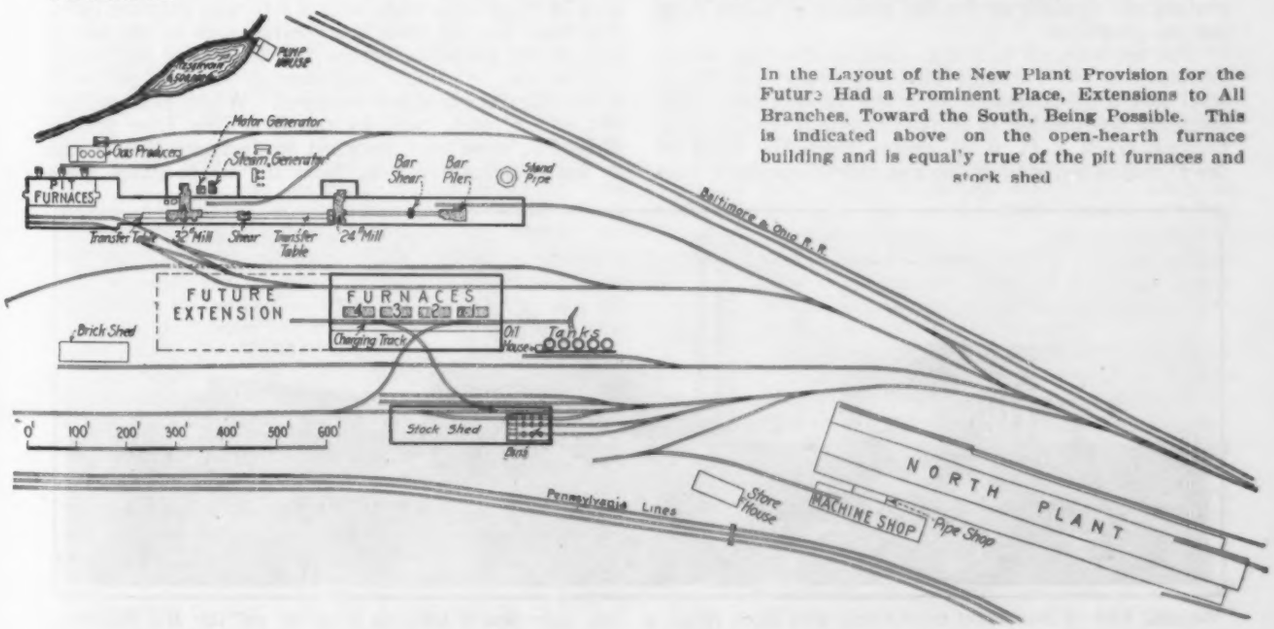
Plans were drawn for an open-hearth department, with four 80-ton furnaces and covered stock house, and a rolling mill department consisting of soaking pits, a 32-in. mill for breaking down the ingots and a 24-in. sheet bar bill. On account of the product of the mills being mainly highly polished sheets, it was held desirable that the steel should be poured by the bottom-case method, in order to guarantee a high grade sheet bar. The general layout plan shows the relation of the steel plant to the tin mills, and of the open-hearth and rolling mill units, indicating in dotted line the future furnace extension.

In view of the peculiar shape of the land, it was early decided to leave a part of the hill on the west side of the property, and to place the stock yard upon it, bringing it on a level with the open-hearth charging floor and parallel to that building. In making the crossovers from the stock yard to the open-hearth building, a new arrangement has been used. Instead of pulling out from the ends of the stock-yard and entering the charging floor at the ends, a double cross-over track extends from each end of the stock yard and crosses to the opposite end of the charging floor, the crossovers connecting with the furnace track between furnaces Nos. 1 and 2 and between Nos. 3 and 4.

The advantage of this layout is that the stock yard engine is able to deliver a drag of loaded pans onto the furnace track over one crossover, and then to back down the floor and remove the empty pan cars to the stock house over the other crossover, performing the two functions by the one shift. By this arrangement, too, it is impossible to have a furnace blocked from charging because another furnace between it and the stockhouse inlet is being charged, as the second charge can come in over the other crossover.

The buildings, furnished by the McClintic-Marshall Co., are of strong, sturdy construction in keeping with the other equipment of the plant. In the stock yard building, which is 77 ft. wide by 300 ft. long, is a 20-ton crane for loading the charges. The first two bays at the south end of this building are occupied by large concrete bins for the storage of limestone, raw dolomite and iron ore. Two tracks run through the east side of the building. The one nearest the open-hearth build-

*Open-hearth superintendent, Mansfield (Ohio) Sheet & Tin Plate Co.



In the Layout of the New Plant Provision for the Future Had a Prominent Place, Extensions to All Branches, Toward the South, Being Possible. This is indicated above on the open-hearth furnace building and is equal'y true of the pit furnaces and stock shed

Bar Mill Building from the East, with Soaking Pit and Gas House Buildings at Rear. In the center foreground may be seen the lower section of 300,000-gal. standpipe under erection

ing is used for loading the charging pans, and is on a level with the charging floor; the other track used for loading is 4 ft. lower. This arrangement brings the tops of the gondola cars of scrap and the charging pans on the same level. This latter track, being 4 ft. lower than the loading track, decreases by this amount the grade of the track leading from the mill level into the stockhouse.

On the brow of the hill outside the stockhouse, and between it and the open-hearth building, are two tracks, one being used as a storage track. The other, nearest the stockhouse, is a run-around track in going from one end of the stockhouse to the other. A 75-ton two-section scale, with self-indicating weightograph attachment furnished by the Buffalo Scale Co., and located on the loading track midway between the crossovers, will weigh all charges. A 150-ton, 4-section railroad track scale, furnished by the same company, is located in the yard between the north plant and the Baltimore & Ohio Railroad.

Charging pan and ingot cars, furnished by the Pittsburgh Steel Foundry Co., are of skeleton steel casting type, equipped with Hyatt roller bearings and with a patent coupling device designed by the foundry company. These cars, in addition to all mill cranes and run out tables, will be lubricated by the Adkins lubricating system.

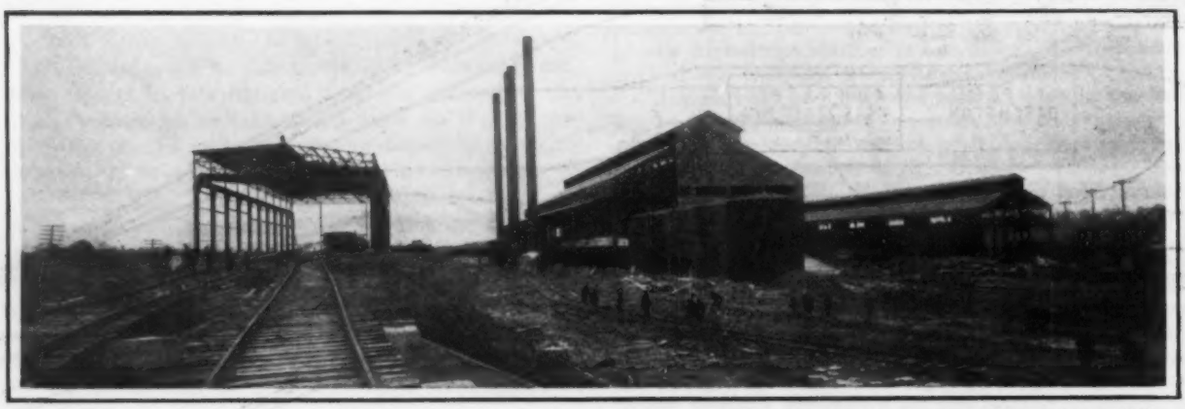
Between the stock yard and open-hearth buildings, and just outside the valve cellar wall of the open-hearth, is a depressed track to allow for passage of cars under the crossover tracks leading from the stockhouse to the open-hearth department. Space has been left on the mill level between the depressed track and the stockhouse for a future installation of gas producers. The depressed track also permits the wheeling of dirt directly onto the cars, when the furnace regenerators are cleaned, or for the removal of ashes from the gas producers.

The open-hearth building, housing the four 80-ton furnaces, is 360 ft. long, with a pouring aisle 65 ft. wide and a 25-ft. leanto over the valve cellar. The charging floor, which is 16 ft. above mill level, has its furnace track 6 ft. 6 in. center from the front of the furnaces, permitting the passage of standard gage cars over it. This arrangement permits the dumping of iron ore and limestone through the tail trestles at each end of the charging floor, and will permit the unloading of a car of brick at a furnace under repairs.

The 80-ton open-hearth furnaces, which are being built by S. R. Smythe & Co., Pittsburgh engineers and furnace builders, are at 80-ft. centers in the building. They are 65 ft. 3 in. long over the brick-work, having a hearth 15 ft. x 35 ft. x 5 ft. deep. They have been designed to burn either oil or natural gas as fuel. They will be started out on oil, five 100,000-gal. tanks having been provided for oil storage. Each furnace hearth is supported upon two piers 8 ft. 7½ in. x 17 ft. 7½ in. x 15 ft. 3¼ in. high, placed 19 ft. apart. These piers are made of 18 in. of wire-cut brick on the outside, and the center filled with concrete. On these piers are placed ten 20-in., 80-lb. beams with 12-in. cross channels, the channels forming the bottom of the pan upon which the hearth is built. The chills at the end of the hearth are made of plates and angles properly braced.

Buckstays supporting the hearth and roof are made of 15-in. beams and channels, the latter reinforced by 1-in. plates riveted to them. The front and back of the furnace pan between the buckstays is made of heavy iron castings properly ribbed. The door castings are designed with the front corner cut away, for the installation of a 4-in. water line to care for the waste water from the doors, this arrangement providing for a very short connection from the door to the telescope pipe.

Port-ends and regenerators are bound with 12-in. beams and channels properly reinforced. The furnace regenerators are 22 ft. 10½ in. long and 9 ft. high from the top of the rider walls to the square of the arch, the gas chambers being 7 ft. 1½ in. and the air chambers 12 ft. 10½ in. wide, with a 3-ft. wall between them. The flues leading from the regenerators to the valves are of the standard design for 36-in. gas and 42-in. air valves, of Blair Engineering Co. design, with which the furnaces are equipped. Waste heat boilers, of 500 h.p. each, built by the Erie City Iron Works, Erie, Pa., have been installed on furnaces Nos. 3 and 4, for utilizing the heat from the waste gases from



General View of New Plant from North, with Stock House at Left, Open-Hearth Building in Center and Bar Mill Building at Right. In foreground are five oil-storage tanks. The difference in level between the two as yet ungraded tracks in the stock house is apparent

the furnaces, 60-in. Blair valves making the connections between the furnaces, the boilers and the stacks. Mechanical draft for the boilers is furnished by 7 ft. 6 in. Sturtevant fans driven by steam turbines. The fans and turbines are located on the leanto floor adjoining the boilers.

Each furnace has five electrically operated charging doors of the Knox water-cooled type, the middle door opening being 48 in. wide x 45 in. high, the others being 42 in. x 42 in. The motors and drums controlling these doors are located on platforms underneath the charging floor, and just back of the regenerators.

A 5-ton high type charging machine of Alliance Machine Co. make, with track span of 14 ft. 6 in., has been installed. This machine is designed with a 2-foot clearance between the charging rails and the lower framework of the machine. The furnace aisle has been designed for the future installation of an overhead crane.

The charging floor between the furnaces slopes gradually to the platform behind the furnaces, which is on a level with the tapping hole platforms. Six-ton electric jib-cranes furnished by the Pittsburgh Crane & Equipment Co. are at the back of each furnace, for the removal of the tapping spouts, which are of the V-shaped steel casting type.

On account of the steel being poured by the bottom cast method, the pouring aisle is traversed by only one track, which will serve alike for the removal of ingots to the pits, slag, dirt, skulls, etc. Two pouring platforms are provided along the building columns on the east side of the building, on the floor in front of which are placed the pouring plates. These plates are 8 ft. 4 in. square and designed to permit the pouring of twelve 14 x 15 in. ingots from one fountain. Five plates will be required to handle the output of each heat, the two pouring platforms being long enough to accommodate twenty-five pouring plates. Between the two platforms is a hydraulic stripper for pushing out sticking ingots. This stripper is equipped with a motor driven pump, making it a self-contained unit. The 90-ton ladles, with sloping bottoms and the nozzle at the lowest point, were made by the Treadwell Construction Co., Midland, Pa.

The pouring aisle has a 125-ton main hoist ladle crane with a 25-ton auxiliary trolley, and a 5-ton stiff-leg crane of the soaking-pit type, both of Alliance Machine Co. make. The stiff-leg crane was designed to be able to strip molds from the ingot, twist the latter from the bottom roots, and pile on the cars for delivery to the soaking-pits, in addition to setting the molds back on the pouring plates. This method of handling bottom-poured ingots guarantees their delivery to the soaking pits as quickly as though they were top-poured.

Overflow of slag from the ladles will be caught in large steel casting boxes of the truncated pyramid type, having a capacity of 165 cu. ft., and placed on the floor alongside the ladles. After the slag is sufficiently cooled for transportation, the box with its contents is placed on a specially designed side dump car large enough to hold one slag chunk, the box is then stripped from the chunk, leaving the slag on the car ready for transportation to the slag dump. The small dirt will be handled in 12-yd. side dump cars. A grinding house with heavy duty 9-ft. pan is on the mill level, and joins the pouring aisle at the south end.

At the south end of the pouring aisle and at a level with the top of the crane girders is a repair platform, arrangements having been made for the future installation of a mono-rail and crane for serving cranes in both the charging and pouring aisles. An escape platform has been provided for the ladle crane operators above the pouring platform, and on a level with the crane cab, extending the entire length of the building. This platform has a runway outside the building, with steps leading to the ground, to allow operators to escape in case of a bad spill.

From the pouring aisle, the ingots are taken to the soaking-pit building, which with the mill building lies to the east of the open-hearth department and runs parallel to it. A space of 100 ft. separates the open-hearth and mill buildings. The soaking pit building, which is 192 ft. long by 77 ft. wide, and with a 20-ft. leanto over the valve cellar, houses three pit furnaces of four holes 5 ft. 6 in. x 8 ft. each, built by the Smythe Co. The arrangement of the pit holes is opposite to that of the usual design, the twelve holes being in line with the length of the building, the covers being designed to back into the leanto building when open, so as to be out of the way of possible damage from the crane.

This arrangement also permits the use of a tunnel running under the line of the twelve pits, which is served by track, slag cars and boxes. Between pits are openings for the removal of the slag boxes by the crane. The pit covers are operated by a special design of shaft driven by motor, with a separate clutch for each cover. By this arrangement one motor will operate the four covers of each furnace.

These furnaces are designed to operate without regenerating the gas, no checkers being placed in the gas chambers and all outgoing ashes passing through the air regenerators. The furnaces are very strongly reinforced with three sections of 20-in. beams with 9-in. vertical channels. The bottom structure of the pit holes consists of 2-in. cast iron plates resting on 12-in. beams. The valves are of the ordinary butterfly type. The stacks are self-supporting, and are 4 ft. 6 in. in diameter and 120 ft. high.

At the east of the soaking pits and at the rear of the stacks is a gas producer building, housing three 10 ft. 6 in. stationary producers equipped with direct

Looking into the Bar Mill Building from the Soaking Pits, with 32-In. Mill in Central Foreground and Motor House at the Left. Beyond the mill are the 8 x 8-in. Mesta shear and the 24-in. Slick sheet bar mill

Lower End of the Open-Hearth Building, from Stock House Scales, with Stacks of Nos. 3 and 4 Furnaces and Two Waste-Heat Boilers. One of the crossovers from stock house to open-hearth building appears in foreground between stacks, while the stacks of the soaking pit furnaces are at extreme left

drive Chapman agitators built by the Chapman Engineering Co., Mt. Vernon, Ohio, which will furnish gas for heating the ingots. Over each producer is a large steel coal hopper of 50-ton capacity, served by a 5-ton Northern crane and grab bucket. The coal is delivered to the gas producers over a trestle, from which it is dumped into a hopper, crushed and conveyed to a bin under the gas producer crane. The single roll crusher and belt conveyor were built by the Webster Co., Tiffin, Ohio. Between the soaking-pit stacks and the gas-house cellar is a depressed track, which permits the wheeling of ashes directly onto a side dump car.

In the soaking pit building and to the west of the pits are three tracks, the two on the outside for the delivery of ingots from the open-hearth building, and the one nearest the pits for the ingot chariot. This building is served by a 5-ton standard type soaking pit Alliance Machine Co. crane. From the pits the ingots are carried by a motor driven chariot, built by the United Engineering Foundry Co., and delivered on the approach table leading to the 32-in. mill, which is of the 3-high type, built by Wm. Tod & Co., Youngstown, Ohio.

The General Electric motor driving this mill is 2000-hp., 240-rpm., 2200-volt., a.c.; the power passing through a 20-ton flywheel, a 5 to 1 reduction gear built by the Morgan Construction Co., then through the pinion housing to the rolls. The hydraulic lift tables are operated by an Aldrich 600-lb. pressure pump and accumulator, the table on the entering side being served by a manipulator car with fingers for turning the ingots.

The 14 x 15 in. ingots will be reduced in eleven passes, the last an edging pass, to 2½ x 7¾ in. bars, after which they pass to an 8 x 8 in. motor driven Mesta shear, from which the cut bars pass to a 24-in. Slick patent sheet bar mill, made by the United Engineering & Foundry Co. The runout tables between these mills, the rolls of which are equipped with Hyatt roller bearings, were made by the Woodard Machine Co., Wooster, Ohio, and lubricated by the Adkins system.

The General Electric 24-in. mill motor is a 2500-hp., 240-rpm., 2200-volt. a.c.; the power passing through a 40-ton flywheel, then through the reduction gear and pinions to a 3-high stand, in which the bars make four passes, being carried from the lower to the upper passes by a series of chutes which form the basis of the Slick patent. From the final pass in the 3-high mill the bars are shoved over to the final pass in the 2-high stand by a hydraulic arm. Both stands of rolls in this mill are in line and run by the one motor.

The bars, after leaving the 24-in. mill, are conveyed by pinch rolls and chutes to a 1 x 8 in. shear made by the Cleveland Punch & Shear Co. and from there to a Kennedy bar piler made by the United Engineering & Foundry Co. Ample cooling beds occupy the space between the bar piler and the end of the building. The mill building, 850 ft. long x 55 ft. wide, is served by a 25-ton and a 10-ton crane of Alliance Machine Co. make. The output of the mill unit, which will consist mainly of a high grade sheet bar for the manufacture of highly polished sheets, will be approximately 10,000 tons of bars per month.

In the 32-in. mill motor room have been installed a 600-kw. General Electric motor generator set and a 400-kw. steam generator set, to insure sufficient power to operate all cranes, in case power should be shut off by the outside source of supply.

Control on all cranes has been furnished by the Electric Controller & Mfg. Co., Cleveland, the general control by the Westinghouse Co.; all small motors and main switchboard by the Westinghouse Electric & Mfg.

Kennedy Bar Piler and 1 x 8-In. Shear Are in Foreground in the Bar Mill Building, with 24-In. Slick Sheet Bar Mill Toward Rear

Co. The yard work is served by a 20-ton, 50-ft. boom McMyler crane and a 40-ton saddle tank American locomotive.

In the general layout of the plant, attention has been given to sewers, water and power conditions. A 36-in. reinforced concrete sewer, into which empty two 24-in. sewers from the open-hearth building and mills, and running west from the creek across the north end of the future extension of the open-hearth building, will care for all waste water. A concrete dam with two 4-ft. flood gates has been placed in the creek near the Baltimore & Ohio tracks, and the creek widened above the dam to accommodate a water storage of 6,500,000 gal. In the pump house adjoining the dam are two 10-in. 2000-gal. per min. Manister centrifugal pumps, which pump the water through a 12-in. line to a 300,000-gal. standpipe, located at the south end of the bar mill building. All water will be measured through a Venturi tube, giving an accurate estimate of the total water consumption.

In the designing of the plant, special attention was given to the elimination of hand labor by the substitution of machinery and labor saving devices. The location of the plant, too, is particularly well chosen, as it has railroad connections with three trunk line roads, the Pennsylvania, the Baltimore & Ohio and the Erie; and, as it is the only steel making unit in the district lying north of Columbus, and between Cleveland-Canton on the east, and Gary on the west, it has a marked advantage in freight rates on the steel scrap produced in this district. It is also close to its supply of pig iron, limestone and coal.

Practical Aspects of Electric Gray Iron

Advantages Over the Cupola—Actual Results from Heats Made Recently—Effect of Nickel and Chromium—Comparative Costs

BY C. H. VOM BAUR*

WHEN it is considered that it takes but very little oxygen in iron to make it weak or blowy and that this oxidation can be overcome by combining it with some of the carbon of the bath at a high temperature, we get a mental picture of what the electric furnace does to insure good iron regularly. As an indication of this phenomenon, iron of practically the same chemical composition, after being superheated in the electric and consequently deoxidized, often for only half an hour or less, shows increased transverse strength of from 2800 to 4800 lb. per sq. in.

More than 10 years ago Schoenawa mentioned briefly some of the possibilities of the electric furnace for gray iron. Some work was done in the next five years, notably at a small foundry in California where coke and pig iron are expensive and scrap and electricity are cheap. However, it was not until 1917, when a basic electric furnace was installed in a Cincinnati plant as described by Elliot two years later, that real interest was aroused among a few to install electric melting and refining furnaces with cupolas as preheating furnaces for the charge, or to install them alone where the electricity is cheap enough. Since then Dr. Moldenke's paper on electric gray iron has appeared, further discussion and tests have been made, as well as new installations. With each new installation the higher quality of the electric gray iron is being recognized. The lesser cost of this superior iron is one cause of the newer installations, irrespective perhaps of the higher quality.

Use of Borings and Turnings

In considering the lower cost of the electric gray iron, as mentioned later on, compared to cupola iron one feature stands out pre-eminently. This feature is also a determining factor of the lower cost of the electric iron. It is the fact that cast iron borings and steel turnings are used for the major part of the charge and no pig iron. Sometimes some cast scrap is used in the mixture of borings and turnings. It is the difference in the cost of the raw materials between the cupola alone and the electric furnace charge, that makes the first main difference in the final saving. Borings have so far really never been used to advantage in the cupola.

When these boring mixtures, with or without turnings and cast scrap, are preheated in a coal or coke fired furnace and then charged hot into the electric, the saving in favor of the electric is even greater. Electricity has to be very cheap indeed, in order to beat out this preheating, yet the preheating always has the advantage of producing a greater output and a greater tonnage for the capital invested. When the cupola duplexes with the electric, the older type can use the cheapest mixtures of all cast scrap, irrespective of the silicon, sulphur, manganese or carbon content. Phosphorus can be entirely absent, as it is not needed, the electric heat producing abundant fluidity. The other four elements can be altered to suit, the test samples taken during the progress of the heat showing what is necessary.

Advantage of Superheating

Further advantages making for the importance of this subject are that as electric iron can be superheated, no cold iron need be poured into pigs for there will not be any; consequently there will be a greater amount of castings shipped compared to the iron poured. Second, there is the deoxidation mentioned in the opening paragraph. Third, with the basic bottom, sulphur is reduced to 0.02 per cent with ease and to traces if desired. The interference of sulphur with the silicon action therefore has no more terrors for the foundrymen. Lastly any adjustments in the chemical composition can be made with ease before pouring.

Some Heats That Have Been Made

Numerous heats have been made recently of which very accurate results were kept. Some of the mixtures have been all No. 2 cast scrap; some 50 per cent cast, 25 per cent borings and 25 per cent turnings. When steel scrap is added, depending on the specifications to be met, different adjustments must be made, and the ease with which these are accomplished is one of the delights of the process. The carbon to be added, when in the form of coke is about three times the theoretical when charged with cold or preheated scrap in the beginning, where steel is part of the charge. It is better to have too much recarburizer than not enough, as it is more difficult to recarburize later on, (unless pig iron is added, which is not economical) than to lower the carbon which is often done by adding steel scrap. This also lowers the silicon somewhat and dis-

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turbs the graphitic carbon ratio, yet the desulphurization at the end of the heat will rectify this to a certain extent, the lower sulphur allowing a lower silicon to do its work in making a gray iron.

Any steel scrap addition also lowers the phosphorus and it can be increased by adding stove plate. As the basic bottom is preferable, in all campaigns made with it the sulphur is lowered with the heavy basic lime slag, fluor spar and coke breeze, all added toward the end of the heat when the superheating takes place. If the carbon is too low, this can be raised by adding coke mixed with enough borings in the form of a brick to make it sink in the molten bath. Manganese usually is not too high but too low. After the bath is only partially melted test samples can be taken, poured into vertical flat bars, chilled on one side, the depth thereof showing the relation of the division of the carbon; after that, adjustments are made as desired.

Thus any chemical and physical changes can be made while the electric is in operation, and these corrections consummated with a degree of finality which is impossible in the cupola, and made at a trifling cost. Thus poor cupola metal can be superheated and refined in half an hour in the electric.

Effects of Nickel or Chromium

The effect of small amounts of nickel and chromium is interesting. The silicon will not do its work of throwing out the carbon, even when the silicon is nearly 2 per cent, with these two elements present in small amounts yet iron with as low a silicon as 1.30 per cent will more than do this when there is no nickel and chromium present. The resulting combined carbon may be as high as 1.25 per cent with the nickel and chromium present and the iron, though hard and extraordinarily strong, can yet be machined.

Scope and Future of Electric Gray Iron

The economical limitations of the electric melting and refining furnace in the iron foundry to-day are defined by the size of the output, not too small and not too large—the price of electricity, available scrap and some form of suitable recarburizer.

The output should not be smaller than 3 to 4 tons a day of 9 to 12 hr. The higher production is perhaps only limited by the size of the electric furnace. A company having a very large foundry, as in the case of some of the large automobile manufacturers, might possess a blast furnace having an output the same as the foundry, a mixer between the two, and the electric might be of 40 or even of 60 tons per heat. At present a 12-ton electric will give 100 tons in 24 hr., when melting cold cast scrap, and 50 per cent more when preheating the scrap. Electric power should not cost over 1.75c. per kw.-hr. Near some of the water power stations it can still be purchased for less than ½c. per kw.-hr. For raw material, the cheaper the borings, turnings and other cheap scrap compared to pig iron prices, the cheaper the process. Recarburizer costs from $4 to $12 per ton, depending on the material and the location.

Concretely, then, what does the process offer? Taking specific cases where electricity is 1.50c. per kw.-hr., turnings and borings $5 per ton; cast scrap $11; pig iron, $24; coke, $10, and an output of 20 tons of electric gray iron in 10 hr., the saving over the cupola, when melting cold scrap in the electric consisting of 75 per cent borings and the balance turnings, is $10 per ton. When this same material is preheated, the saving is $13 per ton. When melting a mixture of all cast scrap in the cupola and refining in the electric, the apparent saving when in the ladle may be only a dollar or two. However, the real saving with any of the foregoing electric processes is in having a greater percentage of merchantable gray iron castings go out of the shipping room for the money expended, compared to any straight cupola castings. This greater ratio of good castings accomplishes another saving, as large as the direct saving mentioned. The so-called semi-steel can also be made in any of these electric processes.

More water powers are now being rapidly developed. Millions of tons of high sulphur scrap are yet to be remelted. Specifications for better and stronger gray irons are called for daily. The cupola alone cannot make the newer and higher class iron and it cannot operate cheaper than it does. Truly this is the age of the electric furnace.

Will Investigate Coal and Other Industries

WASHINGTON, Jan. 3.—As one of the results of the recommendations made by the President's Unemployment Conference, Secretary of Commerce Hoover next week will name a special staff to conduct a survey of the bituminous coal situation. It will relate specifically to intermittency of production and employment as well as to questions of reduction of operating costs and prices, and probably will take five or six months before it is completed. The work is to be financed by funds raised from coal operators, but the cost is not expected to exceed $6,000 or $7,000. The services of engineering societies, superintendents of mines, mine oprators and employers, and others, have been volunteered, and by reason of this co-operation the cost of making the survey will be kept at a minimum, and will make it possible to expedite the work.

The study to be made with regard to the soft coal industry is one of a number of others that will be instituted with regard to intermittent and cyclical employment based on recommendations of the Unemployment Conference. Machinery already has been set up which will enable the conduct of these studies and as pointed out by Secretary Edward Eyre Hunt of the conference, in a recent postscript to the report of the conference itself, public opinion, for the first time in American history, has been focused on unemployment, and municipal committees have been organized for the first time on a nation-wide scale to relieve the situation. Other results of the conference also were stated by Mr. Hunt, such as the unprecedented sale of municipal bonds for public works, the appropriation by Congress of funds for important public works, and the introduction by Senator Kenyon of the bill for long range planning public works.

Changes Proposed in Engineering Contracts

Six changes in engineering contracts are urged by the Engineering Association of Nashville. The association has sent a copy of the proposed changes to the American Engineering Council of the Federated American Engineering Societies, of which it is a member, and to the Association of General Contractors to be considered by them in the drafting of a general uniform engineering condition to a contract. The Nashville recommendation is that the general provisions to a contract should include clauses on the following subjects:

1. A satisfactory arbitration clause should be adopted and should be legally binding on both parties.

2. A definite policy of inspection should be adopted and if two or more separate interests are concerned in payments for work, one authority shall act for all.

3. The contract should specify results, or the method to be followed, but not both.

4. The time of acceptance should be as early and period of maintenance as short as practicable.

5. The contractor should not be held responsible for contingencies beyond his control, and contingencies should be defined.

6. Reasonable limits should be placed upon the engineer's power to increase, or decrease the amount of work to be performed by the contractor.

The Connecticut Labor and Factory Inspection Department estimates the average weekly earnings of factory workers decreased 15 to 20 per cent in 1921.

Lowest Output in Relation to Capacity

(*Continued from page 3*)

of which 332,375 tons were shipped, as compared with 245,133 tons; and steel sheets, of which shipments were 159,069 tons, as compared with 151,513 tons in 1920.

Japan was a very heavy buyer in certain lines. This was particularly true of steel sheets, Japanese purchases of 97,710 tons representing 62 per cent of our entire sheet exports. In rails Japan took 32,589 tons, which is far more than any other country. One explanation of the great quantities of steel sheets taken by Japan is that they are used extensively for roofing, for billboards and for the making of toys and small household utensils. Considerable tonnages also are going to galvanizing plants in Japan.

The table below shows how export shipments of products which are stated in the statistics in tons compared with previous years:

Exports of Iron and Steel, Gross Tons

	1918	1919	1920	1921
January	495,345	360,456	333,601	547,394
February	440,532	234,793	308,185	393,328
March	382,195	344,506	417,216	230,635
April	465,865	408,204	395,120	162,592
May	493,241	447,050	420,359	142,551
June	421,963	544,580	402,707	119,081
July	457,233	287,823	458,866	86,523
August	511,858	396,743	431,484	75,827
September	473,066	363,505	409,200	95,169
October	388,777	302,456	452,015	106,582
November	448,716	295,045	434,297	122,290
December	357,763	254,676	498,765	.....
	5,336,494	4,239,837	4,961,815	2,195,000*

*Estimated.

Wage Reductions

In striking contrast with the preceding year, 1921 was not marked by any serious labor troubles, although numerous threats were made, including that of a general railroad strike to be called on Nov. 1. There were many reductions in wages at iron and steel works. As the year came in, cuts of 20 to 25 per cent went into effect at independent steel mills. The Steel Corporation made its first wage reduction on May 16, amounting to 20 per cent. This reduced common labor from $5.06 to $4.05 per day. Salaries were reduced also. Up to that time the Corporation had adhered to its schedule, announced Feb. 1, 1920, which recorded the ninth advance since Jan. 1, 1916. The Steel Corporation abolished overtime on July 16 and on Aug. 29 made another reduction, bringing the wage of common labor to $3 per day. There was serious unemployment in steel works communities throughout the year. At some Eastern Pennsylvania plants the wages of common labor went as low as $2 per 10-hour day, or to the level of 1915. At some Central Western works the rate for common labor declined to 25 cents per hour as against 30 cents at Steel Corporation plants.

An Unemployment Conference assembled in Washington through the efforts of President Harding and Secretary Hoover adopted various measures to improve the situation and succeeded to some extent.

Federal Trade Commission Cases

The Federal Trade Commission early in May, by a vote of three to two, issued a complaint in the now famous Pittsburgh price basing case, setting forth alleged violation of the Clayton anti-trust act. The Steel Corporation filed its answer about a month later and the Government attorneys have been busy since in studying the case, but it is not known when the hearing will be or when a decision may be expected. The complaint is directed against the Steel Corporation and its subsidiaries only, despite the fact that independent steel producers participated in the hearings and the arguments of the original case in 1919 and 1920.

Another matter before the Trade Commission attracted considerable attention—the charge made on behalf of domestic producers that British makers of ferromanganese and their American agents had been dumping that product in this market. There were protracted hearings. The final decision was that the charge of dumping had not been sustained.

The Federal Trade Commission has taken a position of antagonism to many iron and steel companies in its efforts to compel all such companies to submit to it regular detailed reports of their costs. The demands of the Trade Commission for data and for the filling out of forms entirely different from those used in company business, involving in some cases an expense of thousands of dollars a year, are being contested vigorously and the case is now before the Supreme Court of the District of Columbia.

Consolidation Tendencies

The probability that a number of independent steel companies would be consolidated has been before the trade in the past year or more. The strain all producers were under in 1921 and the prospect that a condition of unprofitable operation would continue for some time have caused leaders in the industry to think seriously of various merger projects. Saving in overhead and the benefits of mass production through concentrating operations in a given line of product at a particular plant have been among the advantages considered. Just as the consolidations of the late eighteen-nineties and the early nineteen-hundreds came after the depression that began in 1893, so the present period of distress for iron and steel works is developing a tendency to concentration.

Seven companies are involved in the most important consolidation project now being worked on: Midvale Steel & Ordnance Co., Lackawanna Steel Co., Youngstown Sheet & Tube Co., Republic Iron & Steel Co., Inland Steel Co., Steel & Tube Co. of America, and Brier Hill Steel Co. Their combined steel ingot capacity is about 20 per cent of the country's total, while that of the Steel Corporation is 45 per cent.

A separate project involving the merger of the Youngstown Sheet & Tube Co., Inland Steel Co. and Steel & Tube Co. of America had been under negotiation before the seven-company merger was seriously taken up. More recently the three-company merger has seemed to have better prospects of consummation than the other. A number of smaller mergers are also talked of, and in the last 10 days of 1921 the American Rolling Mill Co. acquired the Ashland Iron & Mining Co., Ashland, Ky., with its two blast furnaces, six open-hearth furnaces, sheet mills and coal and timber lands.

Profits Disappear

The year was disastrous for producers of iron and steel in all lines. A statement submitted at Chicago in December at the hearing on Lake Superior iron ore rates before an examiner of the Interstate Commerce Commission, made the following showing of deficits in the first three quarters of the year: Republic Iron & Steel Co., $2,177,472; Lackawanna Steel Co., $2,182,687; Midvale Steel & Ordnance Co., $3,933,731. The United States Steel Corporation showed net earnings of $32,286,722 in the first quarter, against $42,089,019 in the first quarter of 1920; $21,892,016 in the second quarter, against $43,155,705 in 1920, and $18,918,058 in the third quarter, against $48,051,540. The corporation paid its preferred and common dividends for all three quarters. After such payments it had a balance of $2,816,905 in the first quarter and deficits of $4,571,668 and $6,965,504 in the next two quarters. The more favorable showing for the Steel

Corporation than for independent companies may be explained in part in the light of the $95,000,000 fund it set aside from surplus "to absorb any sudden and violent diminution in inventory valuations." Charges and allowances for depreciation have been considerably less than in times of good earnings.

Poorest Iron Ore Production in Many Years

Reduced Mining Operations and Ore Shipments—Agitation Concerning Rail Rates Continues

WITH the movement of iron ore from the mines reduced in greater proportion than the consumption, 1921 was the poorest ore year in 17 years. Lake shipments were only 22,300,726 gross tons as compared with 21,226,591 tons in 1904. Compared with these figures is the record year of 1916, when the movement by water was 64,734,198 tons. The average shipments by water during the past ten years have been slightly over 50,000,000 tons.

With the reduced demand for ore, mining operations in the Lake Superior district were materially reduced early in the year and later many mines were shut down entirely. Many ore boats did not leave the docks during the season, the ore cargoes being insufficient to keep half the lake vessel capacity busy. As the iron and steel industry continued to go backward during the first half of the year, early estimates that ore shipments would reach 35,000,000 to 40,000,000 tons were scaled down.

Before the opening of the season of navigation, a number of consumers having long-time contracts advised shippers that they would be unable to take any ore during the year, for, with reduced consumption during the previous winter and early spring, they had carried over enough ore from the previous season to last them through 1921.

There were no reports of sales of Lake Superior ore in the East during the season and very little was taken by Eastern consumers on long-time contracts. Had conditions created a demand, the high freight rates would have shut out lake ore, as delivered prices on foreign ores were much lower. The shipping season got under way very late and with most shippers closed early, there being very little ore shipped after October.

Greatly Curtailed Shipments

Ore shipments were curtailed during the year to a greater extent than the reduction in consumption. As a result, the year 1922 starts with over 3,000,000 tons less ore on the lower lake docks and in furnace yards than on the same date a year ago. On Dec. 1 the amount of ore on docks and at furnace yards was 38,300,000 tons as compared with 41,500,000 tons on Dec. 1, 1920.

On May 1 last, stocks on docks and in furnace yards amounted to 31,500,000 tons, being over 10,000,000 tons greater than on the same date in any previous year. This large surplus was due to the slump in the iron and steel industry that started late in 1920. Figured on the rate of ore consumption in November, 2,188,000 tons, the balance on docks and in furnace yards on May 1 this year would be approximately 27,300,000 tons, or a reduction of over 4,000,000 tons from the amount carried over from May 1 last. However, there was an increase in the rate of consumption in December owing to the blowing in of additional furnaces. The probable balance on May 1 compares with a normal ore reserve at furnaces and at lower lake ports of 18,000,000 to 20,000,000 tons on that date.

Ore Market Lags

Owing to the condition of the iron and steel industry, no interest was taken in the ore market early in the year and ore prices were not fixed until June 16, or the latest in 30 years. The prices named represented a reduction of $1 from the 1920 prices, but with a reduction of 30c. in the vessel rate on ore for last season, the mining companies took a net cut of only 70c. a ton. The new prices brought ore down to within 50c. a ton of the prices that prevailed in 1917, but mine operators claimed that this 50c. reduction was more than offset in advances in transportation costs and taxes over 1917. At any rate, with the light sales, few Lake Superior mines were operated at a profit during the year.

Railroad rates on iron ore was one of the most important matters to which shippers devoted their attention during the year and the only headway made in securing lower rates was a temporary reduction in the carrying charges on ore from both the lower lake ports and the seaboard, which was made by the Interstate Commerce Commission Oct. 20. This was a 28 per cent reduction and brought ore rates virtually back to where they were before the 40 per cent general freight advance Aug. 26, 1920. This reduction was ordered to remain in effect until Jan. 1. In December, the railroads agreed to extend the reduced rates to March 31, but the Interstate Commerce Commission refused to allow this extension of time. This was a victory for lake front furnace and steel interests, some of which had asked that the ore rates be restored Jan. 1, claiming that a reduction in ore rates, without a cut in rates on coal and coke, was a discrimination against them. No further change in rail rates on ore from lower lake ports is expected until the Interstate Commerce Commission makes a general rate reduction.

In connection with the demand for lower rail rates on ore, an application from consuming interests is pending for a reduction in dock handling charges. These charges were advanced 40 per cent shortly after the advance in rail rates, but with the temporary reduction in rail rates, a corresponding reduction in the dock charges was not made.

Lower Rail Rates Asked

While interior furnaces were striving for lower rail rates on ore from Lake Erie docks, the interest of the iron ore mining companies on rate matters was centered largely during the year in efforts to secure lower rail rates from the mines of the Lake Superior district to upper lake ports. In December, 1920, the mining companies belonging to the Lake Superior Iron Ore Association filed a complaint with the Interstate Commerce Commission against the rail rates on ore from the mines to the upper lake ports, charging that the successive rate advances made during the war had brought rates up to a point where they were unjust and unreasonable. With this action pending, the four Michigan and Wisconsin railroads, Feb. 25, 1921, made another advance in rail rates on ore from the old ranges, this advance being 15c. a ton on shipments to Ashland and Escanaba, and 10c. a ton on the rate to Marquette. Mining companies in the two States protested against these advances because the increased rates virtually wiped out the freight differentials that old range mines had previously enjoyed. An appeal was made to the Interstate Commerce Commission to suspend these new rates, but this being refused, the higher rates remained in effect during the shipping season. Later the mining companies consolidated their complaint against the Michigan and Wisconsin rate advances with their bill of complaint asking for a reduction of rail rates on ore from all the Lake Superior districts.

The action to bring down ore rates from the mines to upper lake ports dragged along during the year with the shippers anxious for an early hearing and the railroads apparently playing for a delay. After a postponement made at the request of the railroads, the first hearing finally took place in Chicago in July before an examiner of the Interstate Commerce Commission. The hearing was resumed in Chicago Dec. 7,

when leading representatives of the steel and iron ore interests appeared as witnesses and presentd strong testimony in behalf of lower rates. If this case takes its regular course, a decision by the Interstate Commerce Commission cannot be expected until near the end of this year.

Miners' Wages Reduced

As in other branches of the iron and steel industry, miners' wages were reduced during the year. Successive advances had brought these wages to 171 per cent above the pre-war scale. Several leading independent producers made a 15 per cent wage cut Feb. 1, following cuts by individual companies. The Oliver Iron Mining Co., operating the mines of the Steel Corporation, made a wage cut of 20 per cent May 16, and another cut of 10 per cent Aug. 1. Other wage reductions were made by independent mining companies during the year, and outside of the Steel Corporation mines uniform wage scales to a large extent disappeared. Near the end of the year, some mines resumed operations at further wage reductions, not that they needed to get out the ore, but solely to furnish work for their men who would otherwise have been idle.

Steel Companies Dominate Pig Iron Market

Surplus Bar Important Influence—Downward Tendency Almost Continues Throughout the Year

PIG iron production in the United States in 1921 showed a marked contrast with that of 1920. In 1920 blast furnaces were crowded at maximum capacity to meet the large demands, with a total output of 36,925,987 tons, a figure not far below the best results ever achieved in the greatest production years, whereas in 1921 demand for iron fell off so sharply that the year's total production only slightly exceeded 16,000,000 tons—the lowest mark since the depression of 1908.

Though the operation of steel company furnaces was in larger ratio to capacity than that of merchant furnaces, the decline in output among both classes of producers was a striking reflection of the drastic contraction in consumption of iron and steel in all divisions of the metal-working industry.

Steel company furnaces dominated the pig iron markets throughout the year. Many owners of merchants furnaces kept their stacks in idleness rather than engage in selling iron at prices which in the latter part of the year represented actual losses of several dollars per ton. Those merchant furnaces which remained in blast were constantly in competition with the steel companies on both steel-making and foundry grades. Forced liquidation of iron ore stocks by the steel companies placed iron on the market at constantly declining prices, which were only slightly checked beginning in September, weakness again developing late in the year with some further declines.

On basic iron the net loss during the twelve months is indicated by the January average of $30, Valley furnace, as compared with the December average of $18.62. Foundry iron in the Pittsburgh and other producing districts declined correspondingly.

High Freight Rates

Throughout 1921 the high freight rates greatly reduced the degree of competition between districts. As usual, Buffalo and eastern Pennsylvania furnaces competed actively in New England and other intermediate Eastern territory where freight rates to consuming points were about equal, but in most districts iron business was definitely localized. This, of course, particularly affected the Alabama and Virginia furnaces, which had always been obliged to seek a considerable part of their orders out of their own districts. Very little Alabama iron came north. The Virginia furnaces, with high producing costs and high freight rates, were so completely shut off that in the latter part of the year that iron producing district was entirely idle, not a single furnace remaining in blast.

Features of the Pittsburgh Market

The Pittsburgh pig iron market was headed downward almost constantly from the beginning to the end of 1921. An attempt was made about the middle of August to advance prices, and for about six or seven weeks there was sufficient demand to sustain a rally from $18 to $19, and later to $19.25 for basic and of about $2 in foundry grades, which moved up from $19, Valley furnace, for No. 2 (1.75 to 2.25 silicon) to $21. Before Nov. 1 the market began to give way and December found prices only slightly above the low point of the year reached early in August, when basic touched $18 and No. 2 foundry $19 at Valley furnace. It was one of the worst years the pig iron makers in that district ever experienced as far as business was concerned, and while coke prices were fairly reasonable and even low compared with those of 1920, neither that nor the reduction of $1 per ton in ore, a dip in limestone prices, nor the cut of 30c. per ton in the lake freight on ore, enabled producers to get costs down to a point where profit remained at the prices obtainable. High freight rates kept up costs for all makers, the common claim being that the assembling costs on the materials required for a ton of iron were from $9.60 at Youngstown to about $10.50 at points just outside Pittsburgh, though within the Pittsburgh district. The reduction in ore of $1 per ton did not help much because most makers had a good deal of ore brought down in 1920, which had not been used up and as bearing on costs the ore had previously been written down about $1 per ton. Moreover, purchases of ore were small because the need of supplies did not exist.

The cut in rail rates on ore came practically at the end of the lake shipping season and too much was down at furnaces to help iron makers.

The lot of the merchant producers was a hard one. They had to carry a lot of high priced iron made up against old orders, on which shipping instructions could not be obtained because the buyers were able to do better at other than their regular supply sources, while on the steel making grades and occasionally on foundry iron they were constantly in competition with the steel companies. A Youngstown steel maker made up at least one lot of 10,000 tons of foundry iron and the supposition is that this was not the only instance or that others did not do likewise to some extent. The steel companies made the iron market during much of the year. They were slower to curtail production than were the merchant producers, some being obliged to keep on furnaces to use up coke from by-product plants, which once started cannot be entirely stopped without serious impairment and consequential loss. Little merchant, as distinct from steel company, basic iron, figured in transactions during the year, the bulk of the iron coming from steel works' stacks.

In July the Carnegie Steel Co. went as low as 13 furnaces active out of 59, the lowest point ever touched by the company. Only one merchant furnace in the Pittsburgh district was in blast throughout the year, this being a stack of the American Manganese Mfg. Co., Dunbar, Pa., which was on foundry grade most of the time.

Steel Companies Also Dominated East

During most of 1921, the eastern Pennsylvania pig iron market was dominated by three steel companies, which, however, are regular producers of merchant iron.

The exclusively merchant operators kept their stacks idle during a considerable part of the year, but there was resumption at three or four merchant furnaces late in the year. The price tendency of steel-making and foundry iron was downward, beginning with the first week of January. Re-sale iron was freely offered during the first few months and to a certain extent dominated the market.

Steadily declining prices met with resistance on the part of producers on two or three occasions, even slight advances being put into effect, but these were short-lived. Whenever a fairly good tonnage was inquired for, the competition of producers for the business resulted in further concessions. The price decline halted in August, when $18.50, furnace, was reached on No. 2 plain iron, this comparing with prices of $30 to $32 early in the year on the same grade. Buying became more active when the low price had been reached, the principal large consumers being the cast iron pipe companies, but later in the year the furnace and stove companies were fairly active buyers. The improvement in buying set in in August and was followed by a very good September. In the latter month, the active furnaces succeeded in selling enough iron to fill their order books for the remainder of the year. After the fourth quarter buying had subsided, the market lapsed into quiet again and this continued until inquiries for first quarter of 1921 made their appearance early in December. First quarter buying was in fairly good proportions, but the competition for business resulted in lower prices in late December, despite the expectation of some sellers that first quarter prices would be slightly higher than for the last quarter of 1921. One sale to a New England melter was made at $19.30, eastern Pennsylvania furnace, for No. 2 plain, and though this was a special transaction that was not duplicated, the market settled to $19.50 for No. 2 plain and 50c. or $1 higher for No. 2X at the close of the year. One sale of No. 2 plain was made as low as $18, furnace. Basic iron sold in December at $19, furnace, a net decline in quoted prices of about $14 within the year. Low phosphorus, malleable and gray forge grades were in small demand and prices remained nominal much of the time.

Pig Iron Demand in New England

During the summer months the consumption of pig iron by the New England foundries dropped to within striking distance of the vanishing point, but before the end of the third quarter improved business conditions set in. It is doubtful whether the average melt of the jobbing foundries since improvement in business started has exceeded 30 per cent, at best, of the 1920 average. The showing of New England as a whole probably would run near that figure because of the activities in the textile machinery, heating and stove industries. Makers of such equipment have consumed large pig iron tonnages. The year closed with textile machinery makers less active, the stove makers only fairly so, and the heater interests operating at capacity, while the jobbing foundries were operating indifferently.

Competition for business in New England among furnaces in these two districts has been unusually keen. On the almost steady decline in prices throughout 1921, eastern Pennsylvania furnaces at first were leaders in price cutting. Possibly this was largely due to the activity of the Eastern steel mills for pig iron business. The advent of a Buffalo steel company in the market brought a change in price cutting leadership. Even with a freight differential against them, the Buffalo furnaces by the end of November practically forced the eastern Pennsylvania furnaces to give up the fight for business in New England. The Buffalo furnaces accomplished this by disregarding silicon differentials. Central Pennsylvania furnace interests, entering the market late in the year, were obliged to meet Buffalo prices.

Cincinnati Market Extremely Quiet

The Cincinnati iron market, in common with that of other districts, was a quiet one during the whole of the year 1921. True, there were some spurts, but nothing that could be termed activity developed. Practically all of the jobbing foundries, which cater principally to the machine-tool manufacturers, were closed for several months early in the year on account of a strike of molders, and when this was settled business had fallen away to such an extent that only about one heat a week, on an average, was being secured.

Prices of pig iron steadily declined throughout the year, Southern foundry having been quoted at an average of $36.50, delivered, in January, and at $22, delivered, in the last week of December. The same condition was true of Northern iron, the average quotation for January being $33.77, while that for December was $22.27. Silvery irons showed an even greater decline, the quotation for 8 per cent on Jan. 1 being $52.52, delivered, while on Dec. 29 the quotation was $30.02, delivered.

The output in the Ironton-Ashland district during the year was the smallest for many years. Practically all the furnaces in that district were down for the greater part of the year, and early in February there was only one furnace operating. For the first time in many years, during the month of March, pig iron production in that district ceased entirely, though one silvery furnace in the Jackson County district was in operation during the whole of the year. At the close of the year two furnaces were operating, one at Ironton making foundry iron, and one at Ashland on basic. The prospects for the year 1922 were brighter, as the Portsmouth stack was about ready to go in, and one of the Bessemer furnaces at Ironton was expected to blow.

Cleveland Iron Buying Small

With Ohio foundries operating at around 25 per cent of capacity or less, the demand on lake furnaces for pig iron was light throughout the year. Only two important industries appeared to keep up to near the normal consumption of pig iron, the radiator manufacturers and the makers of enameled iron sanitary ware. These bought iron in liberal quantities. There was virtually no demand from the large stove foundries in this territory. The demand from foundries engaged in automobile work was very light, as large quantities of motor castings were carried over from the year before. Pig iron buying during the year was almost wholly in small lots for early shipment.

At the start of the year there was a large amount of foundry iron carried over on old high priced 1920 contracts. Furnaces have worked this iron off slowly. Different plans have been followed in cleaning up these old contracts, but the more general plan has been for a furnace to ship a consumer one ton of iron at the current market price and another ton on his old contract carrying the high price. There is still a large tonnage of this high-priced iron on the furnace books. A disturbing feature of the market was the offering of considerable resale iron by foundries, either directly or through brokers, during the early part of the year at from $1 to $2 a ton below regular prices.

Prices steadily declined during the first seven months of the year. At the beginning of the year No. 2 foundry iron was quoted at $34 lake furnace. By April it had got down to $25 and late in July to $20. In August the market stiffened up 50c. to $1 a ton, but it gradually slipped back to $20 in October. In December the market was rather weak and some sales were made at $19.50.

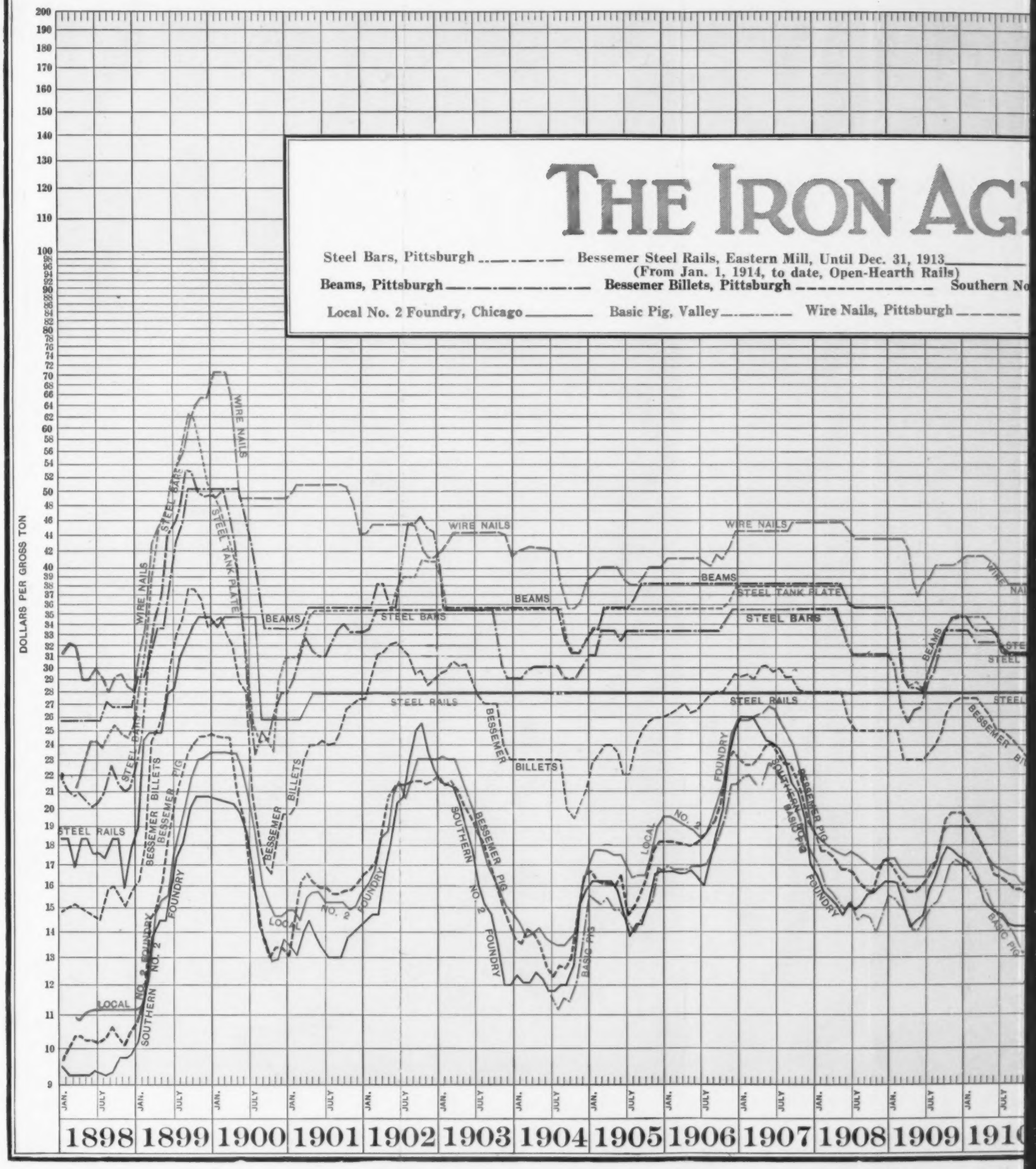
Chicago Pig Iron Market

The dullness of the Chicago pig iron market during 1921 was accentuated by the fact that the agricultural implement industry, ordinarily a large consumer in that territory, was practically idle the entire year. The railroads bought practically nothing until June. At that time, the St. Paul entered the market for iron for its Milwaukee foundry and continued to buy from month to month through the remainder of the year. Railroad equipment manufacturers like Griffin Wheel Co., American Steel Foundries, and others also became more active in the latter half of the year. Buying by

(*Continued on page* 69)

THE IRON AG

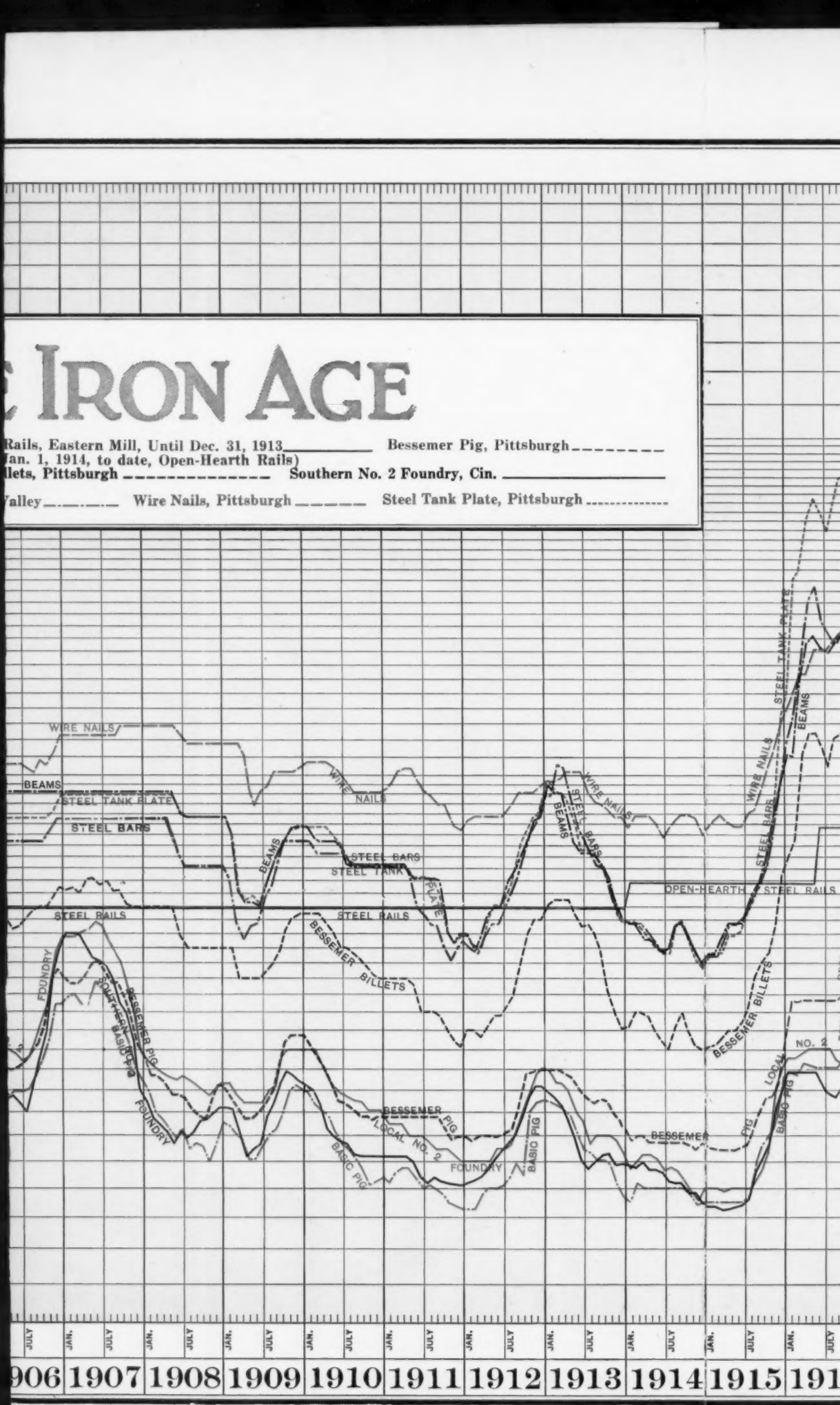
Steel Bars, Pittsburgh — Bessemer Steel Rails, Eastern Mill, Until Dec. 31, 1913
(From Jan. 1, 1914, to date, Open-Hearth Rails)
Beams, Pittsburgh — Bessemer Billets, Pittsburgh — Southern No
Local No. 2 Foundry, Chicago — Basic Pig, Valley — Wire Nails, Pittsburgh



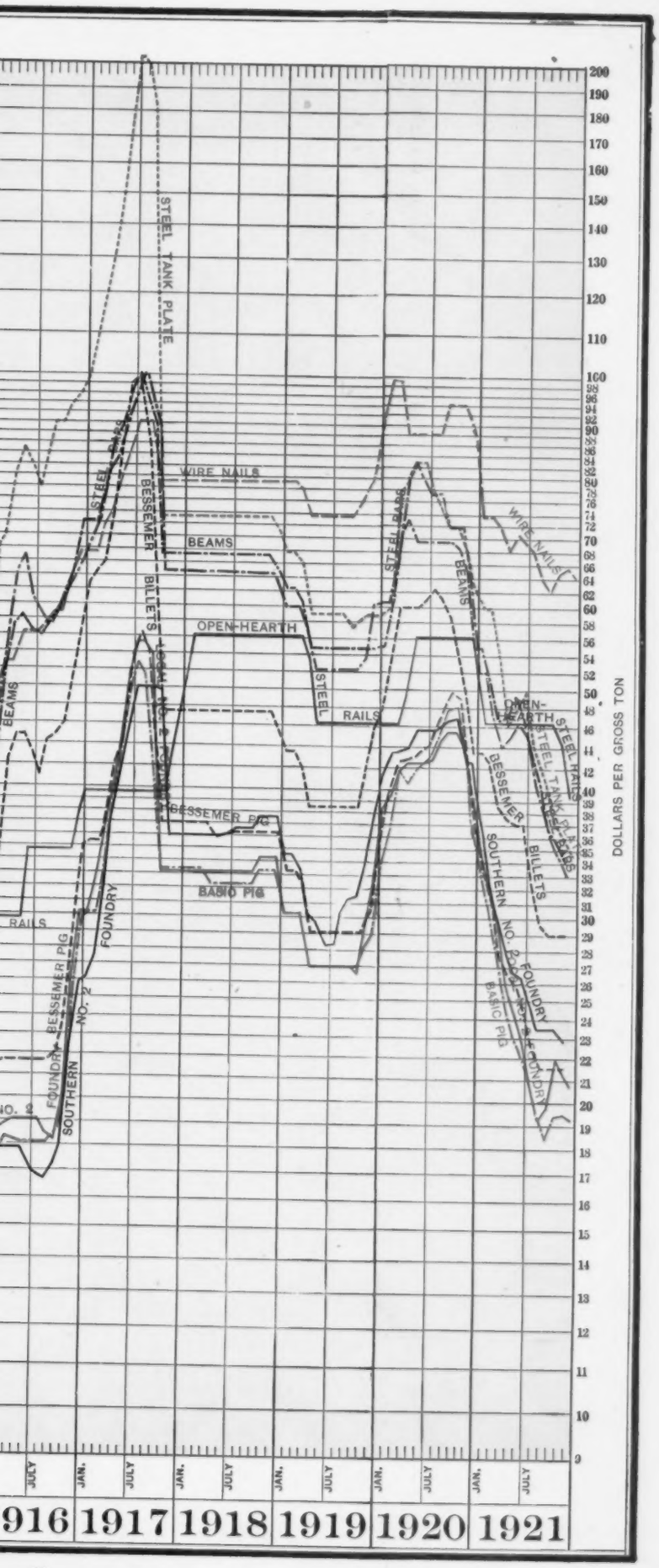
Fluctuations in the Prices of Crude and Fi
1898, to Jan. 1, 1922

IRON AGE

Rails, Eastern Mill, Until Dec. 31, 1913_____ Bessemer Pig, Pittsburgh_____
Jan. 1, 1914, to date, Open-Hearth Rails)
llets, Pittsburgh _____ Southern No. 2 Foundry, Cin. _____
Valley_____ Wire Nails, Pittsburgh _____ Steel Tank Plate, Pittsburgh _____



Prices of Crude and Finished Iron and Steel from J
1898, to Jan. 1, 1922—Gross Tons


STEEL TANK PLATE
WIRE NAILS
BEAMS
OPEN-HEARTH
STEEL RAILS
BESSEMER PIG
BASIC PIG
BESSEMER BILLETS
SOUTHERN NO. 2 FOUNDRY
DOLLARS PER GROSS TON
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
JAN.
JULY
1916
1917
1918
1919
1920
1921

n Jan. 1,

Iron and Steel Prices for Twenty-One Years

Monthly Averages Computed from the Weekly Market Quotations of THE IRON AGE in the Period of 1901-1921

IN this issue of THE IRON AGE are our two annual charts, in which lines are plotted to indicate the course of prices for pig iron, billets and leading forms of finished iron and steel and non-ferrous metals in the 21 years ended with 1921. The diagrams are based on monthly averages of prices quoted week by week in our market reports from the leading selling centers. In the tables following are the monthly average prices on which the charts are based.

Bessemer Pig Iron at Pittsburgh, Dollars per Gross Ton (2240 lb.)

	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921
January	$13.15	$16.70	$22.15	$13.91	$16.85	$18.35	$23.15	$19.00	$17.34	$19.90	$15.90	$15.05	$18.15	$14.96	$14.59	$21.58	$35.95	$37.25	$33.60	$40.00	$33.96
February	14.43	16.93	21.45	13.66	16.41	18.35	22.85	17.90	16.78	19.34	15.90	14.90	18.15	15.09	14.55	21.51	35.95	37.25	33.60	42.90	31.46
March	16.31	17.37	21.85	14.25	16.35	18.28	22.85	17.86	16.25	18.60	15.90	15.09	18.15	15.09	14.55	21.75	37.70	37.25	32.54	43.40	28.16
April	16.75	18.75	21.28	14.18	16.35	18.19	23.35	17.49	15.78	18.27	15.90	15.15	17.90	14.90	14.55	21.95	42.20	36.15	29.35	43.60	26.96
May	16.30	20.75	20.01	13.60	16.16	18.10	24.01	16.93	15.84	17.52	15.90	15.13	17.70	14.90	14.59	21.95	45.15	36.15	29.35	44.03	26.16
June	16.00	21.56	19.72	12.81	16.65	18.23	24.27	16.90	16.05	16.60	15.90	15.15	17.14	14.90	14.70	21.95	54.70	36.38	29.35	44.80	24.71
July	16.00	21.60	18.80	12.40	14.85	18.41	23.55	16.83	16.46	16.40	15.90	15.20	16.70	14.90	14.95	21.95	57.45	36.60	29.35	47.15	22.84
August	15.75	21.62	18.35	12.81	15.20	19.00	22.90	16.23	17.03	16.09	15.90	15.46	16.52	14.90	15.95	21.95	54.75	36.60	29.35	49.11	21.96
September	15.75	21.75	17.22	12.63	15.91	19.54	22.90	15.90	18.05	15.90	15.90	15.15	16.65	14.90	16.85	22.26	48.03	36.60	29.35	50.46	21.96
October	15.89	21.75	16.05	13.10	16.84	20.35	22.00	15.71	19.53	15.90	15.44	17.80	16.60	14.84	16.95	24.08	37.25	36.60	29.35	49.16	21.96
November	16.00	21.68	15.18	14.85	17.85	22.85	20.65	16.59	19.90	15.82	15.00	18.02	16.02	14.59	17.51	30.15	37.25	36.60	31.26	41.10	21.96
December	16.31	21.75	14.40	16.65	18.35	23.75	19.34	17.40	19.90	15.90	15.03	18.15	15.77	14.70	19.65	35.68	37.25	36.60	36.65	36.96	21.96
Average	*15.72*	*20.18*	*18.88*	*13.74*	*16.46*	*19.45*	*22.85*	*17.06*	*17.41*	*17.19*	*15.71*	*15.94*	*17.18*	*14.89*	*15.78*	*23.90*	*43.64*	*36.67*	*31.09*	*44.39*	*25.24*

Basic Pig Iron, f.o.b. Mahoning or Shenango Valley Furnace, Dollars per Gross Ton

January	.....	.....	.....	.....	$15.46	$17.06	$21.90	$16.90	$15.50	$16 87	$13.25	$12.35	$16.41	$12.50	$12.50	$17.81	$30.00	$33.00	$30.00	$37.40	$30.00
February	.....	.....	.....	.....	15.25	16.82	22.00	15.97	15.12	16.31	13.65	12.25	16.30	13.19	12.50	17.60	30.00	33.00	30.00	42.25	27.50
March	.....	.....	.....	.....	15.55	16.85	21.50	15.62	14.94	16.00	13.75	12.81	16 11	13.00	12.50	18.20	32.25	33.00	28.94	41 50	24.20
April	.....	.....	.....	.....	15.06	16.88	21.50	15.25	14.05	15.94	13.75	13.00	15.87	13.00	12.50	18.13	38.75	32.00	25.75	42.40	22.88
May	.....	.....	.....	.....	15.06	17.00	22.90	14.91	14.12	15.19	13.32	13.00	15.15	13.00	12.50	18.00	41.60	32.00	25.75	43.25	22.00
June	.....	.....	.....	$11.76	14.60	16.94	22.40	15.25	14.62	14.70	13.05	13.12	14.80	13.00	12.50	18.00	48.75	32.00	25.75	44.00	20.75
July	.....	.....	.....	11.20	14.00	17.12	21.75	14.51	15.06	14.50	13 12	13.40	14.37	13.00	12.74	18.00	52.50	32.00	25.75	45.85	19.38
August	.....	.....	.....	11.69	14.32	17.70	21.25	14.69	15.25	14.12	13.00	13.94	14.06	13.00	14.06	18 00	51.20	32.00	25.75	48.10	18.20
September	.....	.....	.....	11.60	14.86	18.44	20.06	14.43	15.90	13.70	12 80	14.37	14.00	13.00	14.75	18.31	42.75	32.00	25.75	48.50	19.13
October	.....	.....	.....	12.19	15.25	19.55	19.50	14.04	16.94	13.15	12.52	15.98	13.90	12.81	15.00	19.88	33.00	33.00	25.75	43.75	19 19
November	.....	.....	.....	14.00	16.87	21.37	18.12	14.72	17.25	13.25	12.42	16.37	13.09	12.48	15.75	25.10	33.00	33.00	28.31	36.50	19.00
December	.....	.....	.....	15.70	16.75	21.50	17.50	15.60	17.05	13.40	12.25	16.50	12.71	12.50	17.50	30.00	33.00	33.00	34.25	33.00	18.63
Average	.....	.....	.....	*12.59*	*15.25*	*18.10*	*20.87*	*15.16*	*15.48*	*14.76*	*13.07*	*13.92*	*14.71*	*12.87*	*13.74*	*19.76*	*38.80*	*32.50*	*27.05*	*42.21*	*21.74*

Southern No. 2 Foundry Pig Iron at Cincinnati, Dollars per Gross Ton

January	$13.45	$14.55	$21.65	$12.37	$15.25	$16.75	$26.00	$16.15	$16.25	$17.25	$14.25	$13.25	$16.95	$13.88	$12.40	$17.90	$26.10	$35.90	$34.60	$41.80	$36.75
February	13.12	14.75	21.50	12.12	16.25	16.75	26.00	15.75	16.13	17.06	14.25	13.31	16.69	13.81	12.40	17.90	27.85	35.90	34.60	43.60	32.63
March	14.00	14.75	21.37	12.10	16.25	16.65	26.00	15.50	15.05	16.30	14.25	13.50	16.31	14.00	12.27	17.90	31.90	35.90	33.54	43.60	29.80
April	14.50	16.87	20.15	12.50	16.25	16.63	25.06	15.20	14.25	15.37	14.25	13.75	15.65	13.75	12.24	17.90	37.40	35.90	30.35	44.00	28.00
May	13.85	18.35	18.87	12.25	15.81	16.75	24.25	14.75	14.50	15.00	13.95	14.15	14.94	13.75	12.40	17.90	41.90	35.90	29.85	45.60	26.70
June	13.37	20.19	17.75	11.80	14.65	16.44	24.10	15.25	14.70	14.85	13.44	14.25	14.06	13.63	12.50	17.34	45.15	36.08	28.39	45.60	26.38
July	13.00	20.75	16.15	11.81	13.94	16.06	23.85	15.00	15.75	14.75	13.25	14.70	13.75	13.30	12.71	16.80	49.90	36.60	28.35	45.60	24.75
August	13.00	23.06	15.19	12.00	14.40	17 30	23 00	15.25	16.38	14.31	13.45	15.06	14.06	13.25	13.71	16.70	49.90	36.60	30.40	45.78	23.50
September	13.06	25.00	14.75	12.00	14.37	18 69	21.50	15.65	17 35	14.25	13.31	15 87	14.25	13 25	14.15	17 28	49.90	36.60	31.25	46.50	23 50
October	13.75	25.65	13.50	12.81	15.31	20 00	20.95	15.75	17.88	14.25	13.25	16.80	14.35	12.90	14.78	18.03	49.38	37.60	31.60	46.50	23.50
November	14.00	23.62	12.00	15.19	16.60	22 38	19.50	16.00	17.75	14.25	13.20	17.25	13.87	12.60	16.15	22.40	35.90	37.60	34.35	42.50	22.90
December	14.25	22.44	12.05	15.85	16.75	25.00	17.00	16.25	17.45	14.25	13.19	17.25	13.95	12.80	17.10	25.90	35.90	37.60	38.60	42.50	21.75
Average	*13.61*	*20.00*	*17.08*	*12.73*	*15.57*	*18.37*	*23.10*	*15.54*	*16.12*	*15.16*	*13.67*	*14.93*	*14.90*	*13.41*	*13.58*	*18.67*	*40.07*	*36.52*	*32.16*	*44.47*	*26.88*

Local No. 2 Foundry Pig Iron at Chicago (at Furnace), Dollars per Gross Ton

January	$15.10	$16.25	$23.45	$14.47	$17.85	$19.60	$25.85	$18.45	$17.35	$19.00	$15.50	$14.00	$17.90	$13.75	$13.00	$18.50	$20.00	$33.00	$31.00	$40.00	31.50
February	14.60	16.85	23.35	13 91	17.85	19.41	25.85	18.16	16.75	19.00	15.50	14.00	17.31	14.00	13.00	18.50	32.00	33.00	31.00	42.25	29.00
March	15.60	18 51	23.22	14.05	17.80	19.35	26.10	17.85	16.50	18.30	15.50	14.00	17.25	14.25	12.95	18.70	36.00	33.00	29.94	43.00	25.60
April	15 85	18.97	22.87	14.35	17.60	19.10	26.35	17.73	16.50	17.50	15.00	14.00	17.00	14.25	13.00	19.00	39.25	33 00	26.75	43.00	24.00
May	15 85	20.85	20.72	13 85	17.60	18.90	26.85	17.63	16.50	17.06	15.00	14.50	16.00	14.06	13.00	19.00	43.80	33.00	26.75	43.00	22.80
June	15 35	21.85	19 85	13.70	17.00	18.54	26.60	17 73	16.50	16.75	15.00	14.50	15.62	13.69	13.00	19.00	51 00	33.00	26.75	43.40	20.75
July	15.35	21.60	18 25	13 60	16.47	18.60	25.55	17.55	17 00	16.56	14.87	14.70	14.70	13.75	13.00	19.00	55.00	33.00	26.75	45.25	19.00
August	15.35	22.10	17 22	13.60	16.60	19.45	24.85	17 35	17 13	16 50	14.50	15 37	15.00	13.69	13.44	18.40	55.00	33.00	26 75	46.00	19.55
September	15 35	23.35	16.41	13 85	16.60	20.16	24.10	17.05	18.70	16.40	14.50	16.00	15.00	13.25	13.90	18.13	54.67	33.00	26.75	46.00	21.75
October	15.10	23 35	15.70	14 10	17.66	21.48	22.45	16.85	19.00	16.00	14.46	17.00	15.00	12.94	14.63	19.63	35.00	34.00	27.75	44.50	21.00
November	15.23	23 35	15.10	15 98	19.15	24.70	20.66	17.10	19.00	16.00	14.09	17.75	14 87	12.56	17.13	25.50	35.00	34.00	31.00	39.40	20.60
December	15.85	23 35	14.81	16.95	19.60	25.85	18.80	17.35	19.00	16.00	14.00	18.00	14.30	13.00	18.10	29.50	35.00	34.00	35.75	34.50	19.63
Average	*15.33*	*20.87*	*19.25*	*14.37*	*17.65*	*20.43*	*24.50*	*17.37*	*17.49*	*17.09*	*14.83*	*15.32*	*15.33*	*13.60*	*14.01*	*20.26*	*41.31*	*33.25*	*29.16*	*42.53*	*23.93*

Standard Brands Eastern Pennsylvania No. 2X Foundry Pig Iron at Philadelphia, Dollars per Gross Ton

January	$15.50	$16.75	$22.45	$14.69	$17.50	$18 50	$24.80	$18.25	$17.25	$19.00	$15.50	$14.85	$18 25	$14.65	$14.25	$19 94	$30.10	$34.25	$36.15	$44.10	$33.34
February	15.31	17 19	22.25	14.50	17 50	18.50	25.87	18.25	17 00	18.69	15.50	14.85	18.25	14 94	14.25	20.00	31 88	34.25	36.15	45.10	31 09
March	15 12	18.81	22.25	14.80	17 56	18 35	25 00	18.12	16 37	18.00	15.50	14.92	17.77	15.00	14.25	20 05	37 31	34.25	34.39	45 53	27.59
April	15 46	19.62	21 87	15.00	17.75	18.44	24 81	17.65	16.20	17.75	15 50	15.00	17.40	15 00	14.25	20.50	41.38	34.25	31.90	46.85	26.26
May	15 19	19.75	20.06	14.75	17.81	18.50	25 55	16 94	16.06	17 00	15 50	15 18	16.75	14 81	14.25	20.50	43.60	34.25	30.70	47 10	28 71
June	15 06	20.94	19.19	14.50	16.75	18 44	24 62	16.62	16 42	16 55	15 25	15.31	16.19	14.75	14.25	19.94	48.19	34.29	29.50	47.15	25 50
July	15.00	22.30	18.10	14.31	16.12	18.25	23.06	16 50	16 50	16 25	15.00	15 70	15 60	14.75	14.31	19.75	53.13	34.40	29 08	48.15	23.55
August	14.97	22.00	16.87	14.25	16.25	19.00	21.90	16.50	17.00	16.00	15.00	15.87	15 60	14.75	14 94	19.55	53.00	34.40	29.60	51.96	20.64
September	14 80	22.00	16.12	14.25	16.43	20.44	20.50	16.62	18.05	16.00	15.00	16.59	15 83	14.75	16.00	19.50	51.67	34.40	30.70	53.51	21.22
October	15.25	22.12	15 20	14.43	17.25	21.12	19.85	16.75	18.69	15.81	15.00	17.60	15.95	14.63	16.25	20.31	34.25	38.85	32.10	52 53	22.23
November	15.37	23.37	15.00	15.75	18.05	23.30	18.94	17.00	19.00	15.68	14.95	18.25	15.56	14.50	17.12	24.90	34.25	39.15	35 35	44 99	22.74
December	15.75	23.00	15.00	16.90	18.25	24.00	18.84	17.25	19.00	15.50	14.85	18.25	15.20	14.25	19.05	29.25	34.25	39.15	40.10	35.54	21.52
Average	*15.23*	*20.65*	*18.70*	*14.84*	*17.27*	*19.74*	*23.31*	*17.20*	*17.30*	*16.85*	*15.21*	*16.03*	*16.53*	*14.78*	*15.26*	*21.18*	*41.08*	*35.49*	*32.98*	*46.88*	*25.14*

Mahoning and Shenango Valley No. 2 Foundry Iron, at Furnace, Dollars per Gross Ton

	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921
January	$22.30	$13.00	$16.12	$17.31	$24.60	$16.80	$15 44	$17 00	$13.75	$13.00	$17.50	$12.85	$13.00	$18.50	$31.00	$33.00	$31.00	$39.40	$31.88
February	21.95	12.47	16.00	17.25	24.12	16 00	15.06	16.69	13.75	13.00	17.00	13.19	13.00	18.31	32.00	33.00	31.00	41.50	28 00
March	22.00	12.91	16.00	17 12	24.00	15 56	14.50	16 10	13.75	13 12	16.69	13.25	13.00	18.50	34.75	33.00	29.94	41 25	25 90
April	20.99	13.01	16.00	16.50	24.00	15 15	14.00	15.62	13.75	13 25	15.55	13.25	12.75	18 50	39.75	33 00	26.75	42.80	24 75
May	20.32	12.47	15.55	16.30	25.00	14 87	14.19	15 31	13.75	13.25	14.62	13.00	12.94	18.20	42.40	33.00	26.75	44 25	23 50
June	19.37	11.96	14.81	16.19	25.12	15.00	14.90	14.75	13.56	13.25	14.06	13.00	12.69	18.13	50.25	33.00	26.75	45 00	22 10
July	18.02	11.67	14.25	16.44	22.80	14.80	15.19	14.31	13.50	13.37	13.87	13.00	12.70	18.25	54.50	33.00	26.75	45.00	20 13
August	16.34	11.87	14.15	17.71	22.50	14.50	15.31	14.15	13.50	13.69	14.00	13.00	13.62	18.25	53.20	33.00	26.75	47 00	19.63
September	14.98	11.71	14.56	19.56	20 87	14.47	15.75	13.75	13.44	14.44	14.00	13.00	14.70	18.39	47.00	33 00	26.75	49 40	21 00
October	14.09	12.50	15.50	21.35	19.80	14.36	17.12	13.94	13.37	16.10	13.84	12.90	14.87	20 00	33.00	34.00	26 75	46 50	21 00
November	13.32	14.60	16.83	23.87	19.00	15.25	17.25	13.90	13 20	16.94	13.50	12.75	15.50	25 00	33 00	34.00	31.50	40 25	20.75
December	13.22	16.19	17.35	24.00	17.37	15.50	17.00	13.75	13.00	17.25	13.50	12.75	18.30	30.75	33.00	34.00	36.75	36.20	20.09
Average	*18.08*	*13.36*	*15.69*	*18.63*	*23.43*	*15.19*	*15.48*	*14.94*	*13.53*	*14.22*	*14.84*	*13.00*	*13.98*	*20.07*	*40.33*	*33.35*	*28.95*	*43.21*	*23.21*

Gray Forge Pig Iron, Philadelphia and Vicinity, Gross Ton

	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921
January	$14.50	$15.75	$21.75	$13.50	$16.25	$16.75	$23.50	$16.50	$16.25	$17.25	$14.25	$14.25	$17.65	$14.00	$13.50	$18.44	$28.38	$32.00	$33.90	$40.23	$32.78
February	14.50	15.75	21.25	13.50	15.75	17.00	23.50	16.50	16.25	17.50	14.25	14.25	17.31	14.00	13.44	19.00	29.75	32.00	33.90	40.50	30.90
March	14.00	17.50	20.00	12.75	16.25	16.75	23.50	16.50	16.50	16.90	14.60	14.25	16.87	14.00	13.25	19.00	31.94	32.00	32.84	43.00	26.86
April	14.37	18.25	20.00	13.75	16.25	16.75	23.00	16.00	15.00	16.62	14.75	14.37	16.56	14.00	13.25	19.13	38.50	32.00	29.65	43.00	25.26
May	14.37	19.00	19.50	13.75	16.00	16.50	23.25	16.00	15.00	16.00	14.70	14.50	15.81	13.81	13.25	19.50	40.40	32.00	29.21	43.00	25.26
June	14.37	19.25	18.25	13.50	15.75	16.25	23.00	15.25	15.25	15.65	14.50	14.62	15.37	13.75	13.25	19.25	44.31	32.00	26.25	43.00	24.69
July	14.12	21.75	18.12	13.25	14.50	16.10	22.50	15.25	15.50	15.37	14.50	14.87	14.95	13.75	13.25	18.50	50.05	32.00	25.92	43.00	22.50
August	14.00	21.00	15.50	12.50	15.00	16.50	20.50	15.25	16.25	15.00	14.30	15.37	14.62	13.75	14.50	18.50	49.56	32.00	26.60	45.46	21.20
September	14.00	21.00	14.75	13.00	15.00	17.75	19.50	15.50	17.00	14.75	14.45	15.87	14.56	13.75	15.13	18.50	44.25	32.00	27.00	47.10	20.00
October	14.12	21.00	14.50	12.75	15.75	18.25	18.75	15.50	17.50	14.50	14.25	16.87	15.00	13.62	15.25	19.35	32.20	36.60	28.69	47.10	20.50
November	14.37	22.00	14.00	14.00	16.25	20.00	17.00	15.75	18.00	14.37	14.25	17.62	14.75	13.50	16.05	23.75	32.00	36.60	32.40	44.64	22.50
December	14.87	22.25	14.00	15.50	16.50	22.00	16.75	16.00	18.00	14.25	14.25	17.75	14.58	13.50	17.63	27.69	32.00	36.90	36.10	38.74	21.69
Average	*14.30*	*19.54*	*17.64*	*13.48*	*15.77*	*17.55*	*21.83*	*15.83*	*16.29*	*15.67*	*14.42*	*15.38*	*15.67*	*13.79*	*14.31*	*20.05*	*37.78*	*33.18*	*30.21*	*43.23*	*24.51*

Malleable Pig-Iron at Chicago, Dollars per Gross Ton

	1903	1904	1905	1906	1907	*1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921
January	$23.24	$14.50	$17.50	$19.37	$26.00	$18.60	$17.09	$19.00	$15.50	$14.35	$17.90	$13.88	$13.00	$19.00	$30.94	$33.50	$31.50	$40.50	$32.00
February	23.00	14.50	17.50	19.19	26.00	18.25	16.75	19.00	15.50	14.14	17.31	13.94	13.00	19.00	31.75	33.50	31.50	42.75	29.38
March	22.87	14.00	17.50	19.00	26.25	17.50	16.50	18.40	15.50	14.00	17.25	14.25	13.00	19.40	35.40	33.50	30.44	43.50	25.80
April	21.82	14.00	17.50	18.77	26.50	17.50	16.50	17.50	15.25	14.00	17.05	14.25	13.00	19.50	39.00	33.50	27.25	43.50	24.00
May	20.77	14.00	17.37	18.35	26.60	17.56	16.66	17.06	15.00	14.40	16.00	14.06	13.00	19.50	43.60	33.50	27.25	43.50	23.00
June	19.50	13.85	16.65	18.00	26.25	17.37	16.50	16.75	15.00	14.50	15.62	13.88	13.00	19.50	50.25	33.50	27.25	43.50	21.50
July	18.66	13.75	16.37	18.37	25.62	17.50	16.90	16.56	15.00	14.50	14.65	14.00	13.00	19.50	55.00	33.50	27.25	45.25	19.00
August	17.59	13.75	16.50	18.95	24.80	17.50	17.12	16.50	14.80	15.10	15.00	14.00	13.44	19.00	55.00	33.50	27.25	46.50	19.60
September	16.94	13.50	16.56	20.12	24.40	17.26	18.50	16.40	14.50	16.25	15.00	13.25	14.30	19.00	54.75	33.50	27.25	46.50	21.75
October	16.25	13.75	17.37	21.32	22.40	17.00	18.50	16.06	14.50	17.10	15.20	13.00	15.25	19.88	33.50	34.50	28.25	45.75	21.00
November	15.00	15.87	19.00	24.16	20.25	17.00	19.00	16.00	14.35	17.87	14.87	12.88	17.13	25.80	33.50	34.50	31.50	39.90	20.60
December	14.50	16.50	19.50	26.00	18.75	17.00	19.00	16.00	14.35	18.00	14.63	12.90	18.20	29.50	33.50	34.50	39.50	35.00	19.63
Average	*19.18*	*14.33*	*17.44*	*20.13*	*24.49*	*17.50*	*17.48*	*17.10*	*14.94*	*15.35*	*15.87*	*13.69*	*14.11*	*20.72*	*41.35*	*33.75*	*29.68*	*43.01*	*23.11*

*From this time on the prices are given as at furnace near Chicago, and 35c. to 50c. per ton should be added to get the price delivered to Chicago foundries.

Lake Superior Charcoal Pig-Iron at Chicago, Gross Ton

	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921
January	$19.00	$19.25	$25.60	$16.62	$18.50	$20.40	$26.80	$22.50	$19.50	$19.50	$17.87	$16.00	$18.15	$15.25	$15.75	$19.50	$31.75	$37.50	$38.85	$48.75	$42.50
February	17.50	20.25	26.50	15.87	18.50	20.13	27.00	21.38	19.50	19.50	17.50	15.95	18.00	15.25	15.75	19.75	33.75	37.50	38.85	58.38	39.50
March	17.50	20.65	26.50	15.00	18.50	19.75	26.75	21.25	19.50	19.30	17.50	15.75	18.00	15.25	15.75	19.75	36.75	37.50	38.85	58.20	38.50
April	18.00	21.50	25.30	15.19	18.50	19.44	26.50	20.30	19.50	19.00	17.50	15.75	18.00	15.45	15.75	19.75	40.25	37.50	31.75	57.25	38.50
May	17.50	22.80	24.12	15.00	17.75	19.05	27.40	20.00	19.50	18.62	17.25	15.75	18.00	15.75	15.75	19.75	48.15	37.50	31.75	57.50	37.50
June	17.00	23.50	24.00	14.70	17.00	19.00	27.50	20.00	19.50	18.50	16.80	16.75	16.81	15.75	15.75	19.75	52.88	37.62	31.75	57.50	37.50
July	17.00	25.00	22.20	14.50	16.50	19.06	27.00	20.00	19.50	18.50	16.50	16.25	15.65	15.75	15.75	19.75	57.75	38.00	31.75	57.50	36.37
August	17.00	25.75	20.62	14.87	16.40	19.35	27.20	19.50	19.50	18.50	16.50	16.25	14.69	15.75	16.00	19.75	58.00	38.00	32.25	57.70	33.60
September	17.00	26.00	19.00	14.75	16.87	20.13	27.00	19.50	19.50	18.40	16.50	17.12	15.25	15.75	15.85	19.75	58.00	38.00	32.75	58.50	33.00
October	17.00	26.00	18.10	15.31	18.25	21.50	26.20	19.50	19.50	18.12	16.50	18.65	15.25	15.75	15.75	20.25	37.50	38.00	33.44	58.50	31.50
November	17.50	26.00	17.12	16.37	19.20	24.63	25.12	19.50	19.50	18.00	16.50	18.65	15.25	15.75	17.00	26.46	37.50	38.70	38.50	55.75	31.50
December	18.00	25.25	16.50	17.80	20.00	26.13	24.25	19.50	19.50	18.00	16.37	18.75	15.25	15.75	18.65	31.75	37.50	38.70	43.00	49.13	31.50
Average	*17.50*	*23.50*	*22.13*	*15.50*	*18.00*	*20.71*	*26.56*	*20.24*	*19.50*	*18.66*	*16.94*	*16.80*	*16.53*	*15.60*	*16.13*	*21.33*	*44.15*	*37.88*	*35.29*	*56.22*	*35.96*

THE IRON AGE Composite Iron and Steel Prices

Composite Pig Iron Price

Average of THE IRON AGE *quotations on foundry and basic pig irons; basic iron at Valley furnace; foundry iron an average of Chicago, Birmingham and Philadelphia. Quoted in dollars per gross ton.*

	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921
January	.....	$15.95	$17.30	$23.24	$16.84	$15.68	$17.12	$13.63	$12.65	$16.49	$12.76	$12.38	$17.81	$28.88	$33.21	$31.36	$39.08	$31.18
February	.....	15.84	17.10	23.33	16.30	15.35	16.77	13.83	12.61	16.31	13.18	12.38	17.76	29.75	33.21	31.36	42.35	28.45
March	.....	15.98	17.10	23.02	15.97	15.03	16.29	13.88	12.93	16.07	13.16	12.34	18.06	32.18	33.21	30.10	42.17	25.18
April	.....	15.68	17.03	23.03	15.55	14.38	15.97	13.79	13.09	15.74	13.13	12.37	18.15	38.56	32.71	27.11	42.93	23.73
May	.....	15.63	17.07	23.97	15.16	14.38	15.27	13.53	13.27	14.98	13.06	12.37	18.08	41.87	32.71	26.91	43.64	22.78
June	.....	15.04	16.94	23.47	15.35	14.71	14.90	13.27	13.36	14.35	12.97	12.45	17.91	47.95	32.71	26.46	44.09	21.73
July	$11.84	14.37	16.96	22.51	14.91	15.18	14.72	13.21	13.68	13.99	12.92	12.55	17.79	52.11	32.73	26.37	45.44	20.22
August	12.07	14.64	17.68	21.82	15.05	15.52	14.39	13.12	14.15	13.93	12.91	13.55	17.63	51.43	32.73	26.83	47.38	18.97
September	12.07	14.94	18.59	20.55	15.03	16.41	14.17	12.99	14.74	13.97	12.83	14.28	17.82	46.93	32.73	27.11	47.83	19.89
October	12.67	15.61	19.52	19.88	14.79	17.25	13.79	12.84	16.01	13.93	12.67	14.67	19.18	33.21	34.31	27.52	45.05	19.97
November	14.37	17.01	22.17	18.66	15.21	17.46	13.74	12.71	16.52	13.39	12.42	15.82	24.36	33.21	34.36	30.34	38.65	19.79
December	15.77	17.10	22.82	17.52	15.73	17.26	13.78	12.59	16.63	13.06	12.39	17.34	28.63	33.21	34.26	36.13	34.51	19.11
Average	.....	*15.66*	*18.36*	*21.76*	*15.49*	*15.72*	*15.08*	*13.28*	*14.14*	*14.66*	*12.87*	*13.54*	*19.43*	*38.11*	*33.24*	*28.97*	*42.76*	*22.58*

Composite Price of Finished Steel

Compiled from THE IRON AGE *quotations on steel bars, beams, tank plates, plain wire, open-hearth rails, black pipe and black sheets. Quoted in cents per pound.*

	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921
January	.....	1.713	1.747	1.887	1.923	1.82	1.741	1.615	1.424	1.771	1.451	1.383	2.06	3.384	3.549	3.371	3.158	3.057
February	.....	1.725	1.749	1.899	1.92	1.772	1.736	1.62	1.40	1.766	1.477	1.395	2.203	3.501	3.549	3.371	3.486	2.918
March	.....	1.783	1.746	1.905	1.92	1.599	1.727	1.623	1.394	1.786	1.473	1.413	2.447	3.739	3.549	3.282	3.743	2.764
April	.....	1.793	1.741	1.931	1.92	1.577	1.727	1.627	1.433	1.79	1.446	1.437	2.611	4.110	3.549	3.031	3.842	2.737
May	.....	1.799	1.741	1.933	1.92	1.506	1.72	1.62	1.456	1.727	1.424	1.433	2.75	4.562	3.549	3.021	3.804	2.764
June	.....	1.779	1.763	1.927	1.851	1.506	1.707	1.556	1.47	1.687	1.399	1.444	2.689	5.004	3.549	3.021	3.756	2.643
July	1.702	1.779	1.763	1.927	1.82	1.543	1.657	1.546	1.504	1.667	1.40	1.471	2.64	5.334	3.549	3.021	3.885	2.455
August	1.674	1.783	1.763	1.927	1.82	1.581	1.636	1.539	1.553	1.624	1.446	1.511	2.682	5.249	3.549	3.021	3.967	2.341
September	1.621	1.786	1.763	1.934	1.82	1.616	1.627	1.513	1.61	1.591	1.47	1.559	2.765	5.049	3.549	3.004	3.956	2.248
October	1.620	1.72	1.78	1.934	1.82	1.664	1.613	1.441	1.659	1.559	1.446	1.634	2.856	3.470	3.55	3.052	3.81	2.218
November	1.652	1.723	1.82	1.934	1.82	1.674	1.613	1.407	1.70	1.505	1.397	1.769	3.021	3.444	3.549	3.084	3.566	2.129
December	1.691	1.727	1.87	1.934	1.82	1.727	1.611	1.399	1.725	1.463	1.366	1.941	3.278	3.441	3.461	3.11	3.114	2.107
Average	.....	*1.759*	*1.77*	*1.923*	*1.824*	*1.632*	*1.668*	*1.542*	*1.529*	*1.663*	*1.434*	*1.534*	*2.671*	*4.188*	*3.543*	*3.115*	*3.673*	*2.532*

Billets and Finished Steel

Bessemer Steel Billets at Pittsburgh, Dollars per Gross Ton

	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921
January...	$19.75	$27.50	$29.60	$23.00	$22.75	$26.25	$29.40	$28.00	$25.00	$27.50	$23.00	$20.00	$28.30	$20.13	$19.25	$32.00	$63.00	$47.50	$43.50	$48.00	$43.50
February..	20.21	29.37	29.87	23.00	23.50	26.50	29.50	28.00	25.00	27.50	23.00	20.00	28.50	21.00	19.50	33.50	65.00	47.50	43.50	55.25	42.25
March.....	22.88	31.25	30.62	23.00	24.00	26.70	29.00	28.00	23.00	27.50	23.00	19.75	28.50	21.00	19.70	42.40	66.25	47.50	42.25	60.00	38.40
April.....	24.00	31.50	30.25	23.00	24.00	27.00	30.12	28.00	23.00	26.75	23.00	20.00	28.50	20.80	20.00	45.00	73.75	47.50	38.50	60.00	37.50
May.....	24.00	32.20	30.37	23.00	23.50	26.40	30.30	28.00	23.00	26.12	22.60	20.80	27.37	20.00	20.00	45.00	86.00	47.50	38.50	60.00	37.00
June.....	24.38	32.37	28.87	23.00	22.00	26.63	29.62	25.75	23.00	25.30	21.00	20.87	26.50	19.50	20.50	43.50	98.75	47.50	38.50	61.00	37.00
July.....	24.00	31.75	27.60	23.00	22.00	27.25	30.00	25.00	23.50	25.00	21.00	21.50	26.60	19.00	21.38	41.00	100.00	47.50	38.50	62.50	32.25
August....	24.20	31.06	27.00	23.00	24.00	27.80	29.25	25.00	24.13	24.62	21.00	22.12	26.00	20.25	23.13	44.20	86.00	47.50	38.50	61.00	29.60
September.	24.88	29.50	27.00	20.00	25.00	28.00	29.37	25.00	25.00	24.40	20.75	23.62	24.87	21.00	24.10	45.00	66.25	47.50	38.50	58.74	29.00
October ...	26.70	29.70	27.00	19.50	25.62	28.00	28.20	25.00	26.25	23.75	20.00	26.00	23.30	20.00	24.63	46.25	49.38	47.50	38.50	55.00	29.00
November.	27.00	28.50	24.00	20.25	26.00	28.88	28.00	25.00	27.13	23.30	19.50	27.00	21.00	19.25	26.50	52.00	47.50	47.50	41.38	49.70	29.00
December .	27.50	29.12	23.00	21.20	-26.00	29.50	28.00	25.00	27.50	23.00	19.25	27.00	20.00	19.00	30.60	57.50	47.50	45.50	46.00	43.50	29.00
Average .	*24.15*	*30.32*	*27.93*	*22.08*	*24.03*	*27.41*	*29.23*	*26.31*	*24.61*	*25.40*	*21.43*	*22.39*	*25.79*	*20.08*	*22.44*	*45.95*	*70.78*	*47.33*	*40.51*	*56.28*	*34.46*

Soft Steel Bars at Pittsburgh, Cents per Pound

January...	1.25	1.50	1.60	1.30	1.40	1.50	1.60	1.60	1.40	1.50	1.40	1.15	1.70	1.20	1.10	2.03	3.15	2.90	2.70	2.75	2.35
February..	1.30	1.51	1.60	1.30	1.40	1.50	1.60	1.60	1.35	1.50	1.40	1.12	1.70	1.20	1.10	2.31	3.25	2.90	2.70	3.00	2.15
March.....	1.40	1.60	1.60	1.33	1.50	1.50	1.60	1.60	1.20	1.45	1.40	1.10	1.85	1.20	1.15	2.65	3.63	2.90	2.61	3.63	2.00
April.....	1.47	1.60	1.60	1.35	1.50	1.50	1.60	1.60	1.15	1.45	1.40	1.16	1.84	1.15	1.20	2.88	3.75	2.90	2.35	3.75	2.05
May.....	1.41	1.60	1.60	1.35	1.50	1.50	1.60	1.60	1.19	1.45	1.37	1.20	1.70	1.14	1.20	3.00	4.00	2.90	2.35	3.63	2.10
June.....	1.40	1.60	1.60	1.35	1.46	1.50	1.60	1.45	1.20	1.45	1.25	1.20	1.60	1.11	1.21	2.75	4.25	2.90	2.35	3.50	2.05
July.....	1.40	1.60	1.60	1.35	1.50	1.50	1.60	1.40	1.27	1.45	1.23	1.25	1.50	1.12	1.25	2.63	4.50	2.90	2.35	3.50	1.84
August....	1.44	1.60	1.60	1.35	1.50	1.50	1.60	1.40	1.32	1.40	1.20	1.30	1.40	1.19	1.30	2.56	4.30	2.90	2.35	3.25	1.74
September.	1.50	1.60	1.60	1.31	1.50	1.50	1.60	1.40	1.39	1.40	1.19	1.37	1.40	1.20	1.34	2.60	4.00	2.90	2.35	3.25	1.63
October ...	1.53	1.60	1.60	1.30	1.50	1.50	1.60	1.40	1.51	1.40	1.12	1.45	1.39	1.15	1.44	2.75	2.90	2.90	2.39	3.13	1.55
November.	1.50	1.60	1.37	1.31	1.50	1.54	1.60	1.40	1.50	1.40	1.08	1.55	1.29	1.10	1.62	2.83	2.90	2.90	2.69	2.87	1.50
December .	1.50	1.60	1.30	1.34	1.50	1.60	1.60	1.40	1.50	1.40	1.12	1.66	1.21	1.07	1.84	3.00	2.90	2.80	2.75	2.35	1.50
Average .	*1.43*	*1.45*	*1.56*	*1.33*	*1.48*	*1.51*	*1.60*	*1.49*	*1.33*	*1.44*	*1.26*	*1.29*	*1.55*	*1.15*	*1.31*	*2.67*	*3.63*	*2.89*	*2.50*	*3.22*	*1.87*

Tank Plates at Pittsburgh, Cents per Pound

	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921
January...	1.40	1.60	1.75	1.60	1.50	1.60	1.70	1.70	1.60	1.55	1.40	1.15	1.75	1.20	1.10	2.25	4.45	3.25	3.00	2.72	2.65
February..	1.40	1.60	1.60	1.60	1.50	1.60	1.70	1.70	1.52	1.55	1.40	1.11	1.71	1.20	1.10	2.56	4.88	3.25	3.00	3.50	2.33
March.....	1.47	1.60	1.60	1.60	1.60	1.60	1.70	1.70	1.30	1.55	1.40	1.12	1.70	1.18	1.10	3.10	5.25	3.25	2.91	3.63	2.04
April.....	1.57	1.60	1.60	1.60	1.60	1.60	1.70	1.70	1.27	1.55	1.40	1.21	1.68	1.15	1.15	3.56	5.88	3.25	2.65	3.75	2.10
May.....	1.60	1.60	1.60	1.60	1.60	1.60	1.70	1.70	1.29	1.51	1.39	1.25	1.60	1.12	1.15	3.75	6.60	3.25	2.65	3.75	2.20
June.....	1.60	1.60	1.60	1.60	1.60	1.60	1.70	1.62	1.25	1.48	1.35	1.25	1.45	1.10	1.16	3.63	8.00	3.25	2.65	3.55	1.95
July.....	1.60	1.75	1.60	1.60	1.60	1.60	1.70	1.60	1.33	1.41	1.35	1.30	1.45	1.10	1.22	3.44	9.00	3.25	2.65	3.38	1.85
August....	1.60	1.75	1.60	1.60	1.60	1.60	1.70	1.60	1.40	1.40	1.34	1.35	1.44	1.18	1.26	3.70	8.80	3.25	2.65	3.25	1.78
September.	1.60	1.75	1.60	1.44	1.60	1.60	1.70	1.60	1.46	1.40	1.29	1.47	1.40	1.20	1.34	4.00	8.00	3.25	2.53	3.25	1.64
October ...	1.60	1.84	1.60	1.40	1.60	1.60	1.70	1.60	1.50	1.40	1.17	1.53	1.36	1.14	1.44	4.00	3.25	3.25	2.61	3.09	1.60
November..	1.60	1.82	1.60	1.40	1.60	1.62	1.70	1.60	1.54	1.40	1.13	1.59	1.26	1.08	1.65	4.15	3.25	3.25	2.65	2.81	1.54
December .	1.60	1.82	1.60	1.45	1.60	1.70	1.70	1.60	1.55	1.40	1.15	1.60	1.20	1.05	2.04	4.25	3.25	3.13	2.65	2.65	1.50
Average .	*1.55*	*1.70*	*1.61*	*1.54*	*1.58*	*1.61*	*1.70*	*1.64*	*1.42*	*1.47*	*1.31*	*1.33*	*1.50*	*1.14*	*1.31*	*3.53*	*5.88*	*3.24*	*2.72*	*3.23*	*1.93*

Beams at Pittsburgh, Cents per Pound

	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921
anuary...	1.50	1.60	1.80	1.60	1.50	1.70	1.70	1.70	1.60	1.55	1.40	1.15	1.75	1.20	1.10	1.90	3.25	3.00	2.80	2.47	2.45
February..	1.50	1.60	1.60	1.60	1.50	1.70	1.70	1.70	1.52	1.51	1.40	1.11	1.71	1.20	1.10	2.06	3.25	3.00	2.80	2.70	2.26
March.....	1.52	1.70	1.60	1.60	1.60	1.70	1.70	1.70	1.30	1.50	1.40	1.15	1.70	1.19	1.10	2.40	3.54	3.00	2.71	3.13	2.08
April.....	1.60	1.70	1.60	1.60	1.60	1.70	1.70	1.70	1.27	1.50	1.40	1.21	1.68	1.15	1.20	2.55	3.88	3.00	2.45	3.25	2.10
May.....	1.60	1.60	1.60	1.60	1.60	1.70	1.70	1.70	1.27	1.50	1.39	1.25	1.50	1.14	1.20	2.60	4.00	3.00	2.45	3.10	2.20
June.....	1.60	1.60	1.60	1.60	1.60	1.70	1.70	1.62	1.25	1.48	1.35	1.25	1.45	1.11	1.20	2.53	4.31	3.00	2.45	3.10	2.10
July.....	1.60	1.84	1.60	1.60	1.60	1.70	1.70	1.60	1.33	1.41	1.35	1.30	1.45	1.12	1.25	2.50	4.50	3.00	2.45	3.10	1.93
August....	1.60	2.00	1.60	1.60	1.63	1.70	1.70	1.60	1.40	1.40	1.35	1.35	1.45	1.19	1.30	2.52	4.30	3.00	2.45	3.10	1.82
September.	1.60	2.00	1.60	1.44	1.70	1.70	1.70	1.60	1.46	1.40	1.34	1.42	1.41	1.20	1.35	2.64	4.00	3.00	2.45	3.10	1.64
October ...	1.60	2.07	1.60	1.40	1.70	1.70	1.70	1.60	1.50	1.40	1.21	1.48	1.37	1.15	1.44	2.75	3.00	3.00	2.45	3.05	1.60
November.	1.60	2.05	1.60	1.40	1.70	1.70	1.70	1.60	1.54	1.40	1.13	1.57	1.29	1.10	1.60	2.86	3.00	3.00	2.45	2.89	1.54
December .	1.60	2.00	1.60	1.44	1.70	1.70	1.70	1.60	1.55	1.40	1.15	1.60	1.25	1.07	1.78	3.25	3.00	2.90	2.45	2.45	1.50
Average .	*1.58*	*1.81*	*1.62*	*1.54*	*1.62*	*1.70*	*1.70*	*1.64*	*1.42*	*1.45*	*1.32*	*1.32*	*1.50*	*1.15*	*1.30*	*2.55*	*3.67*	*2.99*	*2.53*	*2.95*	*1.94*

Wire Nails at Pittsburgh, Dollars per Keg of 100 Lb.

	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921
January...	$2.22	$1.99	$1.89	$1.89	$1.75	$1.85	$2.00	$2.05	$1.95	$1.85	$1.71	$1.57	$1.75	$1.54	$1.54	$2.13	$3.00	$3.50	$3.50	$4.50	$3.25
February..	2.30	2.05	1.92	1.90	1.80	1.85	2.00	2.05	1.95	1.85	1.75	1.60	1.75	1.60	1.57	2.25	3.00	3.50	3.50	4.50	3.21
March.....	2.30	2.05	2.00	1.91	1.80	1.85	2.00	2.05	1.95	1.85	1.79	1.60	1.76	1.60	1.60	2.40	3.20	3.50	3.44	4.00	3.02
April.....	2.30	2.05	2.00	1.90	1.80	1.85	2.00	2.05	1.87	1.85	1.80	1.60	1.80	1.60	1.56	2.40	3.28	3.50	3.25	4.00	3.13
May.....	2.30	2.05	2.00	1.90	1.80	1.85	2.00	2.05	1.85	1.82	1.80	1.60	1.80	1.56	1.55	2.50	3.50	3.50	3.25	4.00	3.05
June.....	2.30	2.05	2.00	1.90	1.74	1.85	2.00	1.97	1.70	1.80	1.75	1.60	1.80	1.50	1.55	2.50	3.75	3.50	3.25	4.00	3.00
July.....	2.30	2.05	2.00	1.89	1.70	1.84	2.00	1.95	1.72	1.75	1.70	1.62	1.70	1.52	1.60	2.50	4.00	3.50	3.25	4.00	2.81
August....	2.30	2.05	2.00	1.71	1.70	1.82	2.00	1.95	1.80	1.70	1.69	1.66	1.85	1.56	1.61	2.58	4.00	3.50	3.25	4.25	2.75
September.	2.30	2.03	2.00	1.60	1.74	1.86	2.05	1.95	1.80	1.70	1.65	1.70	1.65	1.60	1.69	2.60	4.00	3.50	3.25	4.25	2.86
October ...	2.28	1.89	2.00	1.60	1.80	1.85	2.05	1.95	1.80	1.70	1.64	1.70	1.63	1.60	1.80	2.63	....	3.50	3.31	4.25	2.90
November.	2.17	1.85	1.97	1.62	1.80	1.88	2.05	1.95	1.80	1.70	1.55	1.70	1.59	1.50	1.87	2.85	3.50	3.50	3.50	4.05	2.84
December .	1.99	1.85	1.87	1.73	1.80	2.00	2.05	1.95	1.85	1.70	1.53	1.72	1.55	1.51	2.04	3.00	3.50	3.50	4.12	3.25	2.69
Average .	*2.26*	*2.00*	*1.97*	*1.79*	*1.77*	*1.86*	*2.02*	*1.99*	*1.82*	*1.77*	*1.70*	*1.64*	*1.70*	*1.56*	*1.67*	*2.53*	*3.52*	*3.50*	*3.41*	*4.09*	*2.96*

Steel Rails at Mill, Dollars per Gross Ton

Bessemer rails to end of 1913; open-hearth rails from beginning of 1914

The extra $2 per gross ton, which has for many years been charged for open-hearth rails, was annulled with the new rail price announced Oct. 22, 1921

	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921
January...	$28.00	$28.00	$28.00	$28.00	$28.00	$28.00	$28.00	$28.00	$28.00	$28.00	$28.00	$28.00	$28.00	$30.00	$30.00	$30.00	$40.00	$57.00	$57.00	$47.00	$47.00
February..	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	30.00	30.00	30.00	40.00	57.00	57.00	47.00	47.00
March.....	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	30.00	30.00	30.00	40.00	57.00	54.50	49.50	47.00
April.....	27.30	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	30.00	30.00	30.00	40.00	57.00	47.00	57.00	47.00
May.....	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	30,00	30.00	35.00	40.00	57.00	47.00	57.00	47.00
June.....	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	30.00	30.00	35.00	40.00	57.00	47.00	57.00	47.00
July.....	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	30.00	30.00	35.00	40.00	57.00	47.00	57.00	47.00
August....	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	30.00	30.00	35.00	40.00	57.00	47.00	57.00	47.00
September.	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	30.00	30.00	35.00	40.00	57.00	47.00	57.00	47.00
October ...	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	30.00	30.00	35.00	.....	57.00	47.00	57.00	45.25
November.	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	30.00	30.00	38.00	.....	57.00	47.00	57.00	40.00
December .	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	30.00	30.00	40.00	.....	57.00	47.00	53.00	40.00
Average .	*27.44*	*28.00*	*28.00*	*28.00*	*28.00*	*28.00*	*28.00*	*28.00*	*28.00*	*28.00*	*28.00*	*28.00*	*28.00*	*30.00*	*30.00*	*34.00*	*40.00*	*57.00*	*49.29*	*54.33*	*45.69*

Monthly Averages of Ferromanganese Quotations

KEY TO CHART ON FERROMANGANESE PRICES

I. August 6, 1914, the first week of the World War, saw German shipments cut off and British deliveries uncertain; ferromanganese sold as high as $150 per ton spot. The average shown is for three weeks.

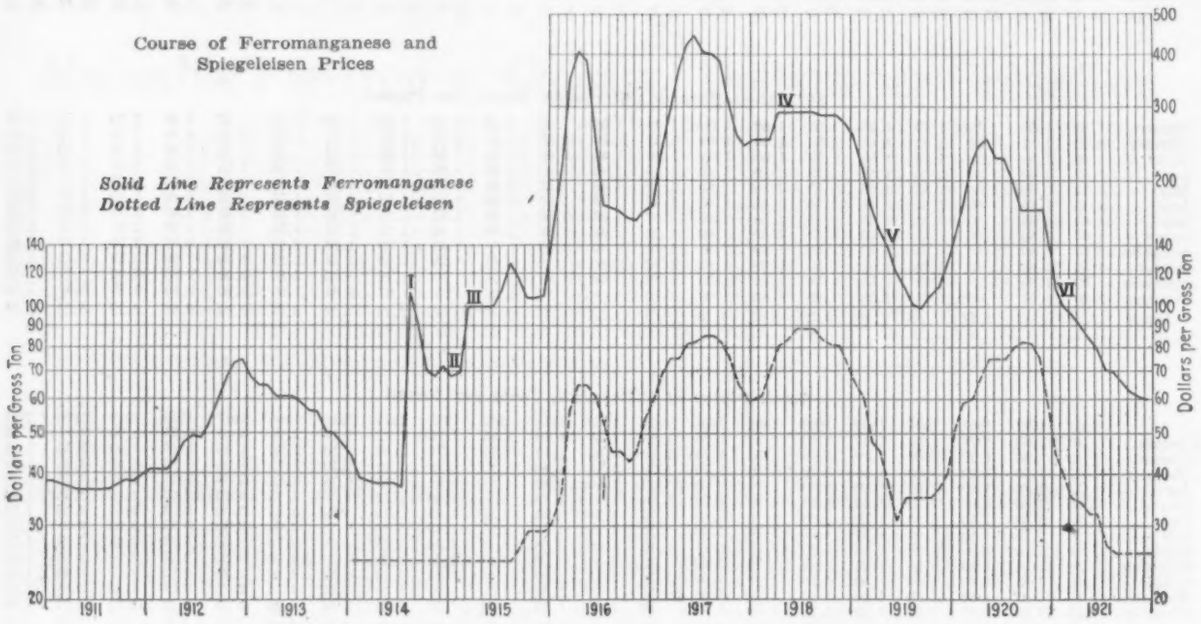
II. During February, 1915, "married contracts" were made by consumers of British ferromanganese holding contracts at $38 per ton, which were averaged with the new $68 quotations. Spot sales were made as high as $90 per ton.

III. Hereafter quotations are based on spot domestic prices. British shipments were uncertain and prices were based on $63 per ton or on "married contracts."

IV. In April, 1918, the standard of ferromanganese was reduced from 80 to 70 per cent with adjustment of $4 per unit from the $250 per ton quotation. We quote 80 per cent.

V. From May 22, 1919, until November 13, 1919, we quote British ferromanganese, which dominated the market at from $5 to $10 below domestic prices.

VI. These quotations are all on a delivered basis.



Ferromanganese Prices in Dollars per Gross Ton

	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921
January	$38.04	$41.00	$68.00	$44.40	$68.00	$150.00	$175.00	$250.00	$255.00	$146.00	$112.50
February	37.69	41.00	65.00	39.25	69.75	207.50	231.25	250.00	215.00	172.50	100.00
March	37.10	41.00	65.00	38.50	100.00	349.60	290.00	250.00	175.00	216.25	96.00
April	36.75	43.00	61.00	38.00	100.00	406.25	362.50	290.00	150.00	240.00	90.00
May	36.50	47.50	61.00	38.00	100.00	387.50	420.50	290.00	138.40	250.00	85.00
June	36.50	49.25	61.00	38.00	100.00	270.00	443.75	290.00	121.00	225.00	80.00
July	36.50	48.88	59.00	37.20	109.00	175.00	406.25	290.00	111.00	225.00	70.60
August	36.70	52.40	56.38	108.33	127.25	172.00	400.00	290.00	101.25	198.75	70.00
September	37.75	59.63	56.00	90.00	117.00	169.75	387.50	285.00	98.75	170.00	65.80
October	38.50	67.80	50.10	70.40	105.00	162.25	310.00	285.00	105.00	170.00	63.00
November	38.40	73.75	50.00	68.00	105.00	160.80	256.00	285.00	112.50	170.00	61.50
December	39.75	75.00	47.00	72.20	106.00	169.75	243.75	275.00	122.50	135.00	60.00
Average	*37.51*	*53.25*	*58.29*	*56.86*	*105.83*	*231.70*	*337.21*	*277.50*	*149.18*	*193.21*	*79.53*

Wire Rod Prices at Pittsburgh for Nineteen Years

Bessemer wire rods, per gross ton. The quotations for November and December, 1917, and all of 1918, are Government prices and apply also to open-hearth rods.

	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921
January	$34.70	$30.00	$31.00	$33.75	$37.00	$34.30	$33.00	$33.00	$28.00	$24.37	$30.00	$25.50	$25.00	$43.00	$75.00	$57.00	$57.00	$60.00	$37.00
February	35.75	30.00	31.00	34.00	37.00	35.00	33.00	33.00	28.75	25.00	30.00	26.38	25.00	48.00	77.50	57.00	57.00	63.75	54.50
March	36.62	30.80	31.70	34.00	37.00	35.00	33.00	33.00	29.00	25.00	30.00	26.50	25.00	54.80	81.00	57.00	55.75	70.00	52.00
April	37.00	31.00	34.00	34.12	37.00	35.00	29.00	32.50	29.00	25.00	30.00	26.00	25.00	60.00	85.00	57.00	52.00	70.00	49.00
May	37.00	30.50	34.00	34.40	37.00	35.00	27.50	32.00	29.00	25.00	30.00	25.50	25.00	60.00	86.00	57.00	52.00	72.50	48.00
June	36.62	29.20	33.30	34.00	37.12	33.50	27.50	30.80	28.25	25.00	29.50	24.50	25.00	53.75	92.50	57.00	52.00	75.00	48.00
July	35.80	28.00	31.87	34.00	36.50	33.00	29.40	29.25	27.00	25.00	28.30	24.50	25.63	53.75	96.25	57.00	52.00	75.00	43.00
August	35.00	28.00	32.10	34.00	36.10	33.25	31.00	28.25	27.00	25.80	28.00	25.00	27.00	55.00	94.00	57.00	52.00	75.00	41.80
September	34.75	27.00	31.12	34.00	36.00	33.00	31.50	28.00	27.00	27.00	27.37	26.20	29.40	55.00	88.75	57.00	52.00	75.00	39.50
October	34.00	26.00	31.75	34.50	35.40	33.00	31.87	28.50	26.00	28.50	26.60	25.88	31.75	55.00	77.25	57.00	52.00	75.00	40.50
November	31.62	26.75	32.10	35.50	34.00	33.00	32.50	28.12	25.30	29.75	25.87	25.25	36.25	63.00	57.00	57.00	54.50	66.40	40.00
December	30.50	29.80	32.50	37.00	34.00	33.00	33.00	28.00	24.50	30.00	25.17	25.00	39.50	68.75	57.00	57.00	59.50	57.00	38.00
Average	*34.95*	*28.92*	*32.20*	*34.44*	*36.18*	*33.84*	*31.08*	*30.37*	*27.40*	*26.29*	*28.40*	*25.53*	*25.29*	*55.84*	*79.77*	*57.00*	*53.98*	*69.55*	*46.94*

Hot-Rolled and Cold-Rolled Strip Steel

Quoted in cents per pound, at Pittsburgh

	COLD-ROLLED STRIP STEEL					HOT-ROLLED STRIP STEEL				
	1917	1918	1919	1920	1921	1917	1918	1919	1920	1921
January	7.00	6.50	6.25	6.00	6.25	....	4.50	3.30	3.45	3.30
February	7.25	6.50	6.25	7.00	6.06	....	4.50	3.30	4.63	3.11
March	7.63	6.50	6.10	7.00	5.83	....	4.50	3.30	5.00	2.93
April	7.31	6.50	5.65	7.75	5.54	....	4.50	3.30	5.25	2.76
May	7.60	6.50	5.65	8.50	4.98	....	4.25	3.30	5.50	2.53
June	8.63	6.50	5.65	8.50	4.88	....	3.50	3.05	5.50	2.50
July	9.00	6.50	5.65	8.50	4.25	....	3.50	3.05	5.50	2.46
August	9.00	6.50	5.65	8.50	3.96	....	3.50	3.31	5.50	2.23
September	9.00	6.50	5.65	8.50	3.78	....	3.50	3.30	5.50	2.00
October	9.00	6.50	5.65	8.25	3.75	....	3.50	3.30	5.25	2.00
November	6.75	6.50	5.65	8.00	3.75	4.50	3.50	3.30	4.70	2.00
December	6.50	6.35	5.93	6.63	3.75	4.50	3.50	3.30	3.65	2.00
Average	*7.89*	*6.49*	*5.81*	*7.76*	*4.73*	....	*3.90*	*3.26*	*4.95*	*2.49*

Wrought Iron and Steel Pipe Prices

Computed from discounts as per list, for carload lots; price for base size pipe, ¾ to 3-in.

Wrought Iron Pipe, per Gross Ton

	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921
January	$67.20	$67.20	$53.76	$49.28	$53.67	$49.28	$58.53	$67.20	$62.72	$53.76	$56.00	$56.00	$60.48	$62.72	$62.72	$72.98	$103.04	$150.08	$143.36	$140.94	$166.68
February	67.20	67.20	53.76	49.28	54.88	49.28	67.20	67.20	57.92	53.76	56.00	56.00	60.48	62.72	62.72	77.40	105.44	150.08	143.36	146.72	166.68
March	67.20	71.90	53.76	52.95	56.00	49.28	67.20	67.20	49.28	53.76	56.00	56.00	60.48	62.72	62.72	82.09	111.42	150.08	140.58	146.72	157.92
April	67.20	73.92	53.76	53.76	56.41	49.28	67.20	67.20	49.28	53.76	56.00	56.00	60.48	62.72	62.72	86.61	125.01	150.08	135.52	146.72	152.54
May	67.20	73.92	53.76	53.76	57.12	49.28	67.20	67.20	49.28	53.76	56.00	56.00	60.48	62.72	64.96	89.60	138.88	150.08	135.52	146.72	144.48
June	67.20	73.92	53.76	51.52	57.12	49.28	70.34	64.06	49.28	53.76	56.00	56.00	62.65	62.72	64.96	89.60	138.88	150.08	135.52	146.72	144.48
July	67.20	73.92	53.76	51.12	57.12	49.28	71.68	62.72	49.28	53.76	56.00	56.00	62.72	62.72	64.96	89.60	149.72	150.08	135.52	146.72	137.01
August	67.20	73.92	53.76	51.12	57.12	49.28	71.68	62.72	53.33	53.76	56.00	56.00	62.72	62.72	64.96	89.60	150.08	150.08	135.52	146.72	135.52
September	67.20	73.92	53.76	51.12	57.12	49.28	71.68	62.72	53.76	53.76	56.00	58.17	62.72	62.72	64.96	91.39	150.08	150.08	135.52	146.72	124.32
October	67.20	73.92	53.76	51.12	49.54	52.17	70.38	62.72	53.76	56.00	56.00	58.24	62.72	62.72	64.96	91.84	150.08	150.08	135.52	146.72	124.32
November	67.20	61.15	53.76	51.12	49.28	53.76	67.20	62.72	53.76	56.00	56.00	60.48	62.72	62.72	67.20	93.03	150.08	150.08	135.52	146.72	124.32
December	67.20	53.76	53.62	51.12	49.28	55.06	67.20	62.72	53.76	56.00	56.00	60.48	62.72	62.72	67.20	98.42	150.08	150.08	135.52	157.78	124.32
Average	*67.20*	*69.89*	*53.75*	*51.44*	*54.56*	*50.33*	*68.46*	*64.70*	*52.95*	*54.33*	*56.00*	*57.11*	*61.68*	*62.72*	*64.59*	*87.68*	*136.90*	*150.08*	*137.25*	*147.16*	*141.48*

Steel Pipe, per Gross Ton

	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921
January	$67.20	$67.20	$56.00	$51.52	$51.70	$47.04	$56.58	$62.72	$58.24	$49.28	$44.80	$40.32	$44.80	$44.80	$42.56	$52.17	$80.64	$109.76	$103.04	$95.20	$95.20
February	67.20	67.20	56.00	53.76	53.76	47.04	58.24	62.72	54.24	49.28	44.80	40.32	44.80	45.88	44.16	55.00	83.04	109.76	103.04	95.20	95.20
March	67.20	71.80	56.00	56.00	54.88	47.04	60.84	62.72	47.04	49.28	44.80	40.32	44.80	45.92	44.80	59.69	89.02	109.76	100.51	95.20	95.20
April	67.20	73.92	56.00	56.00	55.29	47.04	62.72	62.72	47.04	49.28	44.80	40.32	45.51	45.51	44.80	64.21	100.43	109.76	95.20	95.20	88.48
May	67.20	73.92	56.00	56.00	56.00	47.04	62.72	62.72	47.04	49.28	44.80	40.32	46.10	44.80	47.04	67.20	100.80	109.76	95.20	95.20	84.00
June	67.20	73.92	56.00	53.76	56.00	47.04	62.72	59.58	47.04	49.28	44.80	42.56	47.04	44.80	47.04	67.20	100.80	109.76	95.20	95.20	84.00
July	67.20	73.92	56.00	48.16	56.00	47.04	62.72	58.24	47.04	49.28	44.80	43.14	47.04	44.80	47.04	67.20	100.80	109.76	95.20	95.20	80.39
August	67.20	73.92	56.00	48.16	56.00	47.04	62.72	58.24	47.04	49.28	44.80	44.80	45.31	44.80	47.04	67.20	100.80	109.76	95.20	95.20	79.52
September	67.20	73.92	56.00	47.11	56.00	47.04	62.72	58.24	47.04	49.28	44.80	46.37	44.80	44.80	47.04	68.99	100.80	109.76	95.20	95.20	75.04
October	67.20	73.92	56.00	47.98	47.33	49.93	62.72	58.24	49.28	44.80	42.63	47.04	44.80	44.80	47.04	69.44	100.80	109.76	95.20	95.20	70.56
November	67.20	62.55	56.00	51.52	47.04	51.52	62.72	58.24	49.28	44.80	42.56	47.04	44.80	42.63	49.28	70.63	108.27	109.76	95.20	95.20	70.56
December	67.20	58.00	56.00	51.52	47.04	54.41	62.72	58.24	49.28	44.80	40.32	47.04	44.80	42.56	49.28	76.45	109.76	105.64	95.20	95.20	70.56
Average	*67.20*	*70.18*	*56.00*	*51.79*	*53.09*	*48.33*	*61.68*	*60.22*	*49.13*	*48.16*	*44.08*	*43.30*	*45.33*	*44.68*	*46.48*	*68.45*	*106.40*	*109.48*	*98.95*	*95.20*	*88.39*

Cast-Iron Pipe Prices, 1901 to 1921

At New York, 6-Inch, per Net Ton

	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921
January	$21.75	$24.50	$29.25	$24.50	$28.00	$29.75	$34.25	$27.00	$24.50	$25.50	$22.00	$22.00	$25.00	$22.00	$20.00	$29.00	$41.50	$55.35	$65.70	$66.30	$63.30
February	22.25	25.00	29.25	24.25	28.50	29.50	34.25	26.75	24.25	25.50	21.50	22.00	24.75	22.00	20.00	29.33	41.50	55.35	62.70	70.30	63.30
March	21.50	26.25	30.75	24.25	26.75	30.50	34.00	26.25	25.25	25.50	21.00	22.00	23.87	22.00	20.00	29.75	43.10	55.35	62.70	71.30	63.30
April	22.00	26.00	31.00	24.25	27.00	29.75	33.50	26.25	25.00	25.50	21.00	21.25	23.50	22.00	21.60	30.50	50.88	55.35	57.70	73.90	63.30
May	22.25	27.75	30.75	24.00	27.25	31.00	34.25	26.25	25.25	25.50	21.00	21.00	23.00	20.88	22.00	30.50	55.50	56.60	54.45	76.30	62.05
June	23.00	28.00	30.75	23.50	27.25	32.50	33.50	25.75	26.00	25.25	21.00	21.00	23.00	20.50	22.25	30.50	60.75	61.44	52.03	76.30	54.30
July	23.75	28.50	30.75	23.50	27.25	30.25	34.00	25.75	26.25	24.00	21.00	22.10	23.00	20.50	22.50	30.50	65.50	61.75	50.46	76.30	52.30
August	23.75	29.50	29.50	23.50	27.75	30.50	32.50	25.25	26.00	23.50	21.00	22.00	23.00	20.50	23.25	30.50	65.50	61.75	52.33	76.53	46.05
September	23.50	29.50	29.00	23.00	27.25	31.00	33.00	25.75	25.75	23.50	21.00	23.12	23.00	20.40	24.37	30.83	65.50	61.75	54.30	77.22	46.30
October	24.00	29.50	26.00	23.25	28.25	33.00	33.50	25.75	25.50	23.00	21.00	24.50	23.00	20.00	25.25	31.50	61.00	67.70	55.30	77.22	47.30
November	24.50	30.75	24.50	25.00	29.00	33.25	28.50	25.00	25.87	22.12	21.40	24.12	23.00	20.00	26.50	35.50	56.50	67.70	58.30	77.22	47.30
December	23.75	29.25	24.25	27.00	29.25	35.50	28.00	25.50	25.70	22.00	22.00	24.62	22.33	20.00	27.60	41.00	56.50	67.70	61.30	68.87	47.30
Average	*23.00*	*27.88*	*28.31*	*24.17*	*27.79*	*31.33*	*33.77*	*25.94*	*25.44*	*24.24*	*21.24*	*22.48*	*23.37*	*20.90*	*22.94*	*31.62*	*55.31*	*60.65*	*57.27*	*73.98*	*54.68*

Connellsville Coke Prices for Nineteen Years

We present below tables showing monthly prices of prompt shipment Connellsville furnace and foundry coke for 19 years, 1903 to 1921, inclusive, averaged from weekly quotations in THE IRON AGE.

Average Prices of Prompt Connellsville Furnace Coke, per Net Ton at Oven

	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921
January	$5.00	$1.60	$3.46	$2.62	$3.53	$1.92	$1.59	$2.55	$1.40	$1.82	$3.88	$1.85	$1.50	$2.94	$9.50	$6.00	$5.65	$6.00	$5.06
February	5.00	1.52	2.56	2.14	3.50	1.86	1.59	2.12	1.45	1.78	2.52	1.85	1.50	3.38	9.62	6.00	4.44	6.00	4.50
March	5.00	1.65	2.43	2.24	3.02	1.72	1.60	2.00	1.55	2.12	2.40	1.90	1.50	3.47	9.00	6.00	4.06	6.00	4.35
April	4.20	1.60	2.07	2.45	2.72	1.57	1.60	1.77	1.50	2.39	2.15	1.86	1.50	2.41	7.38	6.00	3.65	9.60	3.50
May	3.50	1.50	1.87	2.46	2.16	1.50	1.57	1.66	1.50	2.28	2.13	1.77	1.50	2.30	7.80	6.00	3.89	12.00	3.25
June	3.00	1.45	1.82	2.32	1.89	1.55	1.52	1.65	1.42	2.02	2.11	1.75	1.56	2.49	11.25	6.00	4.00	15.00	3.00
July	2.50	1.45	1.81	2.51	2.40	1.57	1.58	1.59	1.44	2.21	2.45	1.75	1.64	2.75	12.75	6.00	4.07	17.20	2.81
August	2.25	1.45	1.80	2.76	2.62	1.50	1.66	1.57	1.46	2.21	2.50	1.70	1.50	2.80	13.60	6.00	4.31	17.75	2.75
September	2.20	1.45	2.10	2.85	2.82	1.50	2.39	1.60	1.50	2.37	2.29	1.65	1.61	2.94	11.12	6.00	4.56	16.70	3.15
October	1.90	1.47	2.61	2.84	2.85	1.53	2.76	1.59	1.50	3.41	2.98	1.60	2.03	4.88	6.00	6.00	4.52	15.12	3.28
November	1.75	2.04	2.95	3.13	2.41	1.72	2.74	1.50	1.53	3.94	1.82	1.52	2.28	6.90	6.00	6.00	5.87	8.26	3.03
December	1.62	2.12	2.79	3.52	2.06	1.82	2.67	1.44	1.60	4.00	1.75	1.50	2.64	8.38	6.00	6.00	6.12	6.20	2.75
Average	*3.16*	*1.61*	*2.27*	*2.65*	*2.67*	*1.65*	*1.94*	*1.75*	*1.49*	*2.55*	*2.43*	*1.73*	*1.73*	*3.80*	*9.22*	*6.00*	*4.58*	*11.32*	*3.45*

Average Prices of Prompt Connellsville Foundry Coke, per Net Ton at Oven

	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921
January	$6.50	$2.18	$2.38	$3.42	$4.25	$2.45	$3.00	$2.90	$1.90	$1.97	$4.40	$2.50	$2.00	$3.50	$9.75	$7.00	$6.25	$7.00	$6.38
February	6.50	2.10	2.68	2.65	4.00	2.29	1.95	2.70	2.10	2.09	3.25	2.50	2.00	3.50	11.00	7.00	5.00	7.00	5.63
March	6.50	2.25	2.75	2.78	3.65	2.25	1.95	2.60	2.05	2.56	3.00	2.45	2.00	3.75	11.60	7.00	4.94	7.00	5.45
April	5.50	2.15	2.70	2.95	3.31	2.22	1.86	2.45	2.00	2.69	3.00	2.40	2.00	3.56	9.13	7.00	4.30	10.20	4.75
May	4.50	2.00	2.55	2.81	3.00	2.03	1.85	2.20	1.81	2.58	2.85	2.40	2.00	3.25	8.90	7.00	4.31	13.00	4.50
June	3.50	1.90	2.40	2.65	3.00	2.00	1.80	2.17	1.76	2.40	2.80	2.32	2.00	3.25	11.72	7.00	4.56	15.75	4.45
July	3.25	1.80	2.35	2.79	3.00	2.00	2.00	2.15	1.82	2.40	2.70	2.22	2.05	3.25	13.25	7.00	5.00	17.80	4.06
August	3.00	1.75	2.25	3.00	3.08	1.92	1.95	2.15	1.85	2.40	2.90	2.25	2.00	3.30	13.20	7.00	5.25	18.88	3.75
September	2.87	1.85	2.50	3.19	3.20	1.90	2.55	2.12	1.85	2.54	2.90	2.10	2.07	3.31	11.75	7.00	5.80	17.70	4.15
October	2.87	2.00	3.00	3.31	3.25	2.10	2.90	2.10	1.81	3.65	2.81	2.00	2.35	3.88	6.00	7.00	6.25	16.38	4.38
November	2.50	2.25	3.50	4.00	2.75	2.20	3.25	2.05	1.85	4.25	2.60	1.92	2.88	7.10	7.00	7.00	7.00	9.50	4.19
December	2.25	2.35	3.50	4.12	2.50	2.25	3.20	1.97	1.90	4.50	2.50	1.90	2.95	8.63	7.00	7.00	7.00	7.00	3.81
Average	*4.15*	*2.05*	*2.71*	*3.14*	*3.25*	*2.14*	*2.37*	*2.30*	*1.89*	*2.84*	*2.98*	*2.25*	*2.19*	*4.19*	*10.03*	*7.00*	*5.47*	*13.27*	*4.63*

Prices of Spiegeleisen, 1914 to 1921

Dollars per Gross Ton at Furnace

	1914	1915	1916	1917	1918	1919	1920	1921
January	$25.00	$25.00	$30.38	$60.00	$60.00	$66.00	$51.40	$45.00
February	25.00	25.00	36.25	68.75	61.25	60.75	58.75	40.00
March	25.00	25.00	57.00	75.00	71.25	47.00	60.00	35.00
April	25.00	25.00	65.00	75.00	80.75	45.00	67.60	34.00
May	25.00	25.00	66.00	81.00	84.00	37.40	75.00	32.00
June	25.00	25.00	61.00	82.50	89.00	31.25	75.00	32.00
July	25.00	25.00	52.50	85.00	89.00	35.00	75.00	27.00
August	25.00	25.00	45.00	85.00	89.00	35.00	80.00	26.00
September	25.00	26.60	45.00	82.50	82.75	35.00	82.00	26.00
October	25.00	29.25	42.75	76.25	82.00	35.00	81.88	26.00
November	25.00	29.25	45.40	66.00	80.25	37.00	75.62	26.00
December	25.00	29.25	55.00	60.00	74.38	40.00	59.10	26.00
Average	*25.00*	*26.20*	*50.09*	*74.75*	*78.78*	*42.08*	*70.11*	*31.25*

Scrap Prices at Chicago 1905 to 1921

These Prices Are Averaged from Weekly Quotations in THE IRON AGE

Heavy Melting Steel Scrap, per Gross Ton

	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921
January	$14.88	$14.95	$16.80	$11.05	$13.94	$16.00	$11.75	$10.75	$12.60	$9.35	$9.19	$15.50	$21.12	$30.00	$17.40	$24.50	$15.13
February	14.13	13.63	15.75	12.50	13.56	15.50	12.06	10.75	12.13	10.50	9.56	14.75	21.50	30.25	15.06	25.00	15.13
March	14.45	13.00	16.00	11.44	12.13	15.00	12.15	10.94	12.08	9.81	9.63	16.50	23.70	29.87	15.63	24.25	12.50
April	14.38	13.50	15.75	11.05	12.35	14.44	11.75	11.56	12.50	9.80	9.15	16.50	27.00	28.75	16.41	23.75	11.00
May	12.55	13.70	15.60	10.62	13.44	13.56	10.50	12.05	11.25	9.69	9.37	15.94	28.70	28.80	15.62	23.00	11.50
June	11.95	13.13	16.35	11.62	14.50	13.15	10.38	12.12	10.44	9.75	9.44	14.80	36.50	29.00	16.69	22.95	10.81
July	12.75	13.13	16.12	11.75	14.06	12.38	10.69	11.69	10.50	9.75	10.40	14.50	33.00	29.00	19.40	24.13	10.00
August	13.15	14.10	15.10	12.88	15.00	12.25	11.05	12.25	10.56	9.69	11.56	15.25	29.60	29.00	20.88	25.35	10.60
September	14.38	16.50	14.75	13.00	16.00	12.25	10.70	12.81	10.06	9.19	11.75	16.06	31.25	29.00	19.10	24.81	11.31
October	14.50	16.60	14.70	13.45	16.43	12.25	10.00	13.95	10.00	8.50	11.75	16.81	26.00	29.00	18.25	21.50	12.44
November	15.20	17.50	12.63	14.88	16.00	12.25	9.75	13.69	9.56	8.06	13.44	20.60	27.60	28.50	20.88	18.45	12.25
December	15.25	17.13	11.50	15.17	16.00	12.10	10.25	12.88	9.00	8.43	15.63	23.00	28.37	22.75	21.80	16.20	11.13
Average	*13.96*	*14.74*	*15.08*	*11.87*	*14.45*	*13.43*	*10.92*	*12.12*	*10.89*	*9.38*	*10.91*	*16.68*	*27.86*	*28.66*	*18.09*	*22.82*	*11.98*

Old Steel Rerolling Rails, per Gross Ton

	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921
January	$16.00	$16.50	$19.00	$12.30	$15.81	$18.00	$13.69	$13.00	$16.15	$11.10	$9.62	$17.06	$27.00	$35.00	$22.10	$34.25	$15.63
February	15.13	16.25	19.00	13.00	15.12	18.00	13.63	12.80	15.50	11.81	9.87	17.06	27.00	35.00	16.44	34.38	15.50
March	15.30	15.70	19.00	12.19	13.06	17.80	13.65	12.75	15.00	11.56	10.25	17.65	28.00	34.75	16.38	32.30	13.30
April	15.44	15.75	18.50	12.60	13.20	17.60	13.44	12.88	14.63	11.50	10.25	18.00	32.62	33.50	17.55	32.13	12.63
May	14.06	16.00	18.60	12.94	14.44	17.12	13.40	13.50	13.95	11.31	10.25	17.38	36.50	34.00	17.75	31.75	13.40
June	12.95	15.88	18.94	13.94	15.50	16.50	12.38	13.50	12.69	11.50	10.25	15.85	46.90	34.00	18.75	32.65	12.94
July	13.56	15.50	18.00	14.50	15.40	15.88	12.25	13.50	12.25	11.50	10.30	15.25	45.19	34.00	25.15	35.00	12.25
August	14.35	15.90	17.00	15.63	16.12	15.31	12.65	14.00	12.12	11.50	12.25	15.80	39.20	34.00	29.50	38.00	12.45
September	15.25	17.63	16.75	16.18	17.15	15.25	12.75	15.00	12.25	10.75	13.35	17.06	39.75	34.00	26.80	38.13	13.13
October	15.63	18.63	17.15	15.80	18.00	15.25	12.44	16.30	12.15	10.00	13.31	18.81	34.75	34.00	27.19	33.44	14.00
November	16.30	21.15	15.06	17.19	18.00	15.06	12.30	16.50	12.00	9.50	14.44	24.50	34.80	33.50	31.25	22.90	13.80
December	16.50	21.00	12.94	16.95	18.00	14.20	12.50	16.50	11.33	9.50	16.63	28.63	35.25	27.50	31.90	16.90	12.63
Average	*15.04*	*17.16*	*17.50*	*14.44*	*15.82*	*16.34*	*12.93*	*14.19*	*13.34*	*10.96*	*11.73*	*18.59*	*36.58*	*33.60*	*23.40*	*31.90*	*13.47*

No. 1 Railroad Wrought, per Net Ton

	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921
January	$18.19	$17.30	$16.35	$11.20	$13.81	$14.88	$11.75	$11.63	$12.70	$8.70	$8.69	$15.88	$23.50	$31.25	$19.10	$26.00	$13.63
February	17.00	15.88	15.50	12.44	12.88	14.69	12.00	11.30	12.19	9.50	8.87	14.94	23.75	31.25	15.13	27.00	13.50
March	16.40	14.88	15.25	11.25	11.43	14.45	12.30	11.44	12.13	9.06	9.00	16.20	25.90	30.75	15.88	27.10	11.60
April	16.06	14.50	15.25	11.00	11.90	14.19	11.69	12.31	12.38	9.00	8.65	17.00	30.35	30.20	16.05	27.25	10.00
May	14.19	14.50	15.45	10.75	12.81	12.87	11.38	12.75	11.25	9.00	8.94	16.50	32.60	29.75	15.69	26.38	10.40
June	13.50	13.50	16.06	11.69	13.38	12.75	11.25	12.57	10.56	9.00	9.00	15.20	41.00	29.75	16.87	25.25	9.63
July	14.13	13.50	15.06	12.15	13.16	12.44	11.00	12.06	10.55	9.00	9.15	14.94	37.75	29.75	18.60	24.88	9.25
August	15.45	14.50	14.40	12.69	14.44	11.94	11.10	12.50	10.62	8.94	10.44	15.30	33.70	29.75	20.75	24.75	10.45
September	16.31	16.13	14.38	13.44	15.35	11.94	10.94	13.13	10.19	8.37	11.00	16.38	35.50	29.75	19.50	23.88	11.50
October	17.00	17.50	14.60	13.60	15.94	11.75	10.44	14.25	9.60	7.87	11.19	17.50	28.75	30.36	19.38	20.25	13.00
November	17.50	18.00	12.32	14.38	15.31	11.94	10.20	13.50	9.00	7.56	12.94	21.00	30.90	28.68	22.88	16.85	12.20
December	18.00	17.25	11.00	14.83	14.75	11.65	10.75	13.06	8.50	7.90	15.38	25.13	31.25	24.62	24.10	14.60	10.44
Average	*16.14*	*15.62*	*14.64*	*12.45*	*13.76*	*12.96*	*11.23*	*12.54*	*10.81*	*8.66*	*10.27*	*17.16*	*31.25*	*29.06*	*18.66*	*23.68*	*11.20*

No. 1 Cast Scrap, per Net Ton

	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921
January	$13.81	$14.70	$17.80	$12.95	$13.06	$14.88	$12.19	$11.25	$12.90	$10.20	$9.19	$13.31	$15.50	$25.40	$22.95	$37.25	$17.25
February	13.13	13.50	18.25	13.00	12.75	14.88	12.13	11.25	12.69	10.87	9.00	12.81	15.37	26.06	20.00	38.88	18.00
March	13.40	12.75	19.50	12.12	12.19	14.50	12.25	11.31	12.50	10.37	9.00	13.45	16.90	27.25	21.63	37.85	14.90
April	13.81	12.94	18.88	12.05	12.60	13.69	11.81	12.06	12.44	10.25	9.00	12.88	20.43	27.12	21.45	37.25	13.25
May	12.50	13.40	18.55	11.50	13.31	13.13	11.00	12.20	11.60	10.06	9.00	12.56	23.20	26.70	20.12	37.38	13.60
June	12.40	13.50	18.94	12.00	13.81	13.00	10.75	11.81	10.63	9.75	9.00	11.75	30.00	27.12	20.75	36.30	12.75
July	13.38	13.50	18.44	12.15	13.44	13.00	10.50	11.75	10.70	9.65	9.25	11.50	29.25	28.06	23.30	36.50	12.25
August	13.20	14.00	16.75	12.75	14.06	12.75	10.55	12.15	10.87	9.50	9.62	11.50	24.20	29.10	24.50	36.20	12.60
September	13.38	15.38	16.81	12.88	14.75	12.75	10.10	12.81	10.62	9.19	10.10	12.13	23.75	30.00	24.20	34.00	13.44
October	13.63	15.90	16.25	13.25	15.63	12.50	10.25	14.20	10.40	9.00	10.50	13.50	20.50	30.36	25.00	28.75	13.88
November	14.30	17.50	14.00	13.75	15.12	12.50	10.35	13.50	10.06	8.56	12.13	15.55	22.00	28.87	28.12	23.00	13.50
December	15.00	17.50	13.00	13.92	14.75	12.30	11.00	13.25	9.83	9.00	13.75	16.25	23.50	25.75	32.35	18.70	12.63
Average	*13.50*	*14.55*	*17.96*	*12.69*	*13.79*	*13.38*	*11.07*	*12.30*	*11.27*	*9.70*	*9.96*	*13.10*	*22.05*	*27.69*	*23.70*	*33.51*	*14.00*

Railroad Malleable Scrap, per Net Ton

	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921
January	$14.06	$15.00	$17.20	$10.40	$12.88	$15.00	$10.94	$10.88	$13.40	$9.25	$8.13	$13.81	$17.75	$26.80	$17.60	$29.00	$14.75
February	13.69	14.25	16.00	11.31	12.38	14.69	10.50	10.30	13.00	10.38	8.00	13.33	17.31	26.80	14.87	29.94	15.50
March	13.44	13.00	16.25	10.00	11.50	14.50	11.00	10.44	13.00	9.56	7.94	13.95	17.95	27.89	16.13	28.50	13.80
April	13.25	13.38	16.38	10.10	11.25	13.69	11.00	11.19	13.19	9.15	8.00	13.89	20.37	28.25	15.80	27.63	12.13
May	12.38	13.50	16.25	9.81	12.38	12.94	10.38	11.55	12.10	9.13	8.14	13.44	23.30	29.30	15.25	26.50	12.60
June	11.90	13.50	17.50	10.25	12.94	12.20	10.10	11.75	11.06	9.00	8.13	11.73	31.62	29.50	16.00	25.65	11.50
July	12.31	13.38	16.75	11.40	12.75	11.25	10.00	11.75	10.60	9.00	8.90	11.63	30.12	29.71	18.70	27.00	11.19
August	13.15	13.60	16.00	12.06	13.69	11.00	10.05	12.05	10.38	8.88	10.00	11.25	29.70	30.36	20.50	28.75	12.00
September	14.19	15.00	16.00	12.38	15.15	11.20	10.00	12.56	10.19	8.25	10.25	11.50	30.75	30.36	18.95	27.63	13.06
October	14.25	15.13	16.20	12.45	15.25	11.00	9.69	13.75	9.65	7.90	10.25	12.38	25.25	30.36	19.06	23.50	13.50
November	14.55	17.30	12.25	13.44	15.13	11.25	9.50	13.56	9.31	7.75	11.38	16.00	25.60	29.18	23.12	19.45	13.10
December	15.00	18.00	10.50	13.70	14.95	11.25	10.06	13.50	9.00	7.95	13.75	18.00	27.35	22.75	25.70	15.00	11.44
Average	*13.61*	*14.59*	*15.61*	*11.44*	*13.35*	*12.50*	*10.37*	*11.94*	*11.24*	*8.55*	*9.41*	*13.41*	*24.76*	*28.44*	*18.47*	*25.71*	*12.88*

Frogs, Switches and Guards, Cut Apart, per Gross Ton

	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921
January	$14.88	$15.00	$17.40	$11.40	$14.00	$16.00	$11.50	$10.50	$12.65	$9.30	$9.19	$15.50	$21.60	$30.00	$17.40	$24.50	$15.13
February	14.06	14.75	16.25	12.38	13.56	15.50	11.88	10.50	12.13	10.50	9.86	14.75	21.69	29.75	15.06	25.00	15.13
March	14.50	13.70	16.50	11.69	12.50	15.00	12.10	10.88	12.13	9.81	9.63	16.50	23.70	29.87	15.38	24.25	12.50
April	14.25	13.50	16.50	11.50	12.55	14.50	11.63	11.38	12.44	9.90	9.15	16.50	26.75	29.00	16.15	23.75	11.00
May	13.31	13.70	16.90	11.56	13.44	13.69	10.38	11.80	11.30	9.69	9.38	15.94	28.70	29.00	15.63	23.00	11.50
June	12.10	13.13	17.25	11.62	14.50	13.15	10.20	11.88	10.44	9.69	9.44	14.63	36.50	29.00	16.69	22.95	10.81
July	12.75	13.25	16.81	12.30	14.15	12.38	10.44	11.56	10.50	9.75	10.45	14.50	33.00	29.00	19.40	24.13	10.00
August	13.15	14.30	15.50	14.00	14.88	12.25	10.70	11.95	10.56	9.69	11.56	15.25	29.60	29.00	20.88	25.35	10.55
September	14.38	16.63	15.50	13.63	15.95	12.25	10.38	12.63	10.19	9.19	11.75	16.06	31.25	29.00	19.10	24.81	11.31
October	14.50	17.13	15.30	13.85	16.63	12.25	9.94	13.75	10.00	8.75	11.75	16.81	26.00	29.00	18.25	21.38	12.44
November	15.40	18.30	12.69	14.50	16.06	12.25	9.65	13.44	9.56	8.19	13.44	20.95	27.60	28.00	20.88	18.45	12.25
December	15.50	18.00	11.63	14.95	16.00	12.10	10.13	12.63	9.00	8.40	15.63	23.25	28.37	22.75	21.80	16.20	11.13
Average	*14.07*	*15.12*	*15.69*	*12.78*	*14.58*	*13.44*	*10.74*	*11.91*	*10.91*	*9.41*	*10.94*	*16.72*	*27.90*	*28.21*	*18.05*	*22.81*	*11.98*

Old Carwheels, per Gross Ton

	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921
January	$16.56	$19.00	$24.90	$20.10	$15.75	$18.38	$13.00	$13.25	$16.95	$11.65	$9.94	$14.63	$18.87	$30.00	$25.90	$36.13	$21.00
February	16.38	19.00	23.50	16.94	15.25	17.88	13.00	13.05	16.75	12.44	10.00	13.94	18.25	30.00	22.75	38.06	20.63
March	15.75	18.60	23.88	15.50	14.69	17.00	13.25	13.00	16.75	11.88	9.94	14.30	20.25	30.00	21.50	36.20	15.90
April	15.88	18.75	25.00	14.00	14.50	16.50	13.25	13.25	16.75	11.55	9.75	13.88	23.62	29.00	21.50	37.50	14.06
May	14.81	19.00	25.20	12.88	14.81	15.75	12.75	13.90	15.05	11.50	9.75	12.95	27.35	29.00	21.25	37.50	14.70
June	14.25	18.00	25.38	13.00	15.81	15.50	12.55	14.13	13.94	11.50	10.19	12.44	39.00	29.00	22.00	35.90	13.31
July	14.38	18.00	24.25	13.30	16.00	14.81	12.50	13.88	12.90	11.25	11.30	12.50	35.25	29.00	23.95	35.75	12.75
August	14.95	18.50	24.50	15.50	16.25	14.50	12.85	13.70	12.75	11.25	11.04	11.60	30.40	29.00	26.25	38.35	12.95
September	15.75	19.75	24.50	15.50	18.05	14.00	12.81	14.38	12.63	11.06	11.80	11.69	31.87	29.00	24.90	37.69	14.19
October	16.00	19.31	24.38	15.25	18.31	14.00	12.50	16.00	12.10	10.65	12.00	12.94	25.75	29.00	24.88	36.06	16.50
November	17.10	22.60	23.13	15.50	18.50	13.50	12.10	16.69	12.00	9.81	13.31	17.30	28.15	29.00	28.63	31.95	16.60
December	18.75	25.00	22.00	16.00	18.50	13.50	13.06	16.75	11.88	9.60	14.56	21.25	31.00	26.75	31.10	24.40	15.75
Average	*15.58*	*19.63*	*24.22*	*15.29*	*16.37*	*15.44*	*12.80*	*14.33*	*14.30*	*11.18*	*11.13*	*14.12*	*27.48*	*29.06*	*24.55*	*35.46*	*15.70*

Philadelphia Scrap Prices, 1901 to 1921

These Prices, Delivered Eastern Pennsylvania, Are Averaged from Weekly Quotations in THE IRON AGE

Heavy Melting Steel Scrap—Per Gross Ton

	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921
January	$14.90	$18.30	$20.00	$11.56	$17.44	$17.33	$18.61	$11.70	$16.94	$17.00	$12.50	$12.19	$14.40	$10.40	$10.00	$16.38	$21.70	$30.00	$17.20	$24.75	$14.50
February	15.62	19.00	20.19	12.56	17.37	16.62	18.69	14.25	15.58	16.62	13.50	11.70	12.87	11.00	10.00	16.50	20.63	30.00	14.75	25.62	14.25
March	16.00	20.12	20.75	14.00	17.62	15.80	18.87	13.12	13.50	16.50	14.05	11.80	13.25	11.31	10.80	16.90	23.50	29.00	14.19	25.20	13.00
April	16.75	20.87	20.75	14.69	17.56	16.69	18.75	12.75	13.25	16.12	13.31	12.94	13.44	10.95	11.00	17.88	24.88	28.00	15.50	24.12	11.25
May	16.55	21.00	20.56	12.50	15.94	16.30	18.95	12.81	14.75	14.75	13.00	13.50	12.10	10.63	11.25	16.60	25.40	29.00	15.00	23.37	11.80
June	15.75	20.94	20.50	11.35	14.55	15.75	18.75	13.25	15.81	14.45	13.00	13.50	11.75	10.50	11.10	15.31	24.13	29.00	16.12	22.60	11.25
July	15.81	21.00	19.00	11.12	15.16	15.87	17.62	13.80	15.80	14.12	13.19	13.50	11.35	10.30	12.06	14.94	25.20	29.00	18.90	22.62	11.00
August	16.70	20.50	17.37	11.75	15.55	16.75	16.85	14.50	16.87	13.75	13.15	13.65	11.43	10.19	13.75	14.75	31.88	29.00	19.37	25.00	11.40
September	16.44	20.50	15.87	11.90	15.69	17.94	16.50	15.19	17.40	13.85	12.50	14.50	11.62	10.69	15.00	14.75	30.25	29.00	18.62	25.62	11.50
October	17.50	20.55	13.85	12.87	16.56	18.12	15.35	15.00	18.00	13.81	11.94	15.10	11.15	9.95	14.75	15.63	25.00	29.00	19.10	22.75	12.06
November	17.19	20.50	11.87	14.75	17.55	18.70	12.94	15.75	18.00	13.50	11.55	15.50	10.19	9.25	14.65	20.13	26.00	28.00	20.62	19.00	11.87
December	17.81	20.25	11.25	16.20	17.50	19.50	11.50	17.10	17.50	12.65	12.08	15.25	10.00	9.40	15.81	23.75	28.20	25.00	22.50	15.25	11.50
Average	*16.42*	*20.29*	*17.66*	*13.94*	*16.54*	*17.11*	*16.95*	*14.10*	*16.12*	*14.76*	*13.81*	*13.69*	*11.96*	*10.38*	*12.81*	*16.96*	*27.23*	*28.67*	*17.66*	*23.89*	*13.18*

Heavy Cast Scrap—Per Gross Ton

January	$14.50	$14.40	$19.75	$12.75	$16.00	$16.00	$21.70	$15.30	$15.87	$17.00	$14.00	$13.42	$14.50	$12.00	$12.00	$17.00	$20.20	$30.00	$23.80	$36.00	$23.25
February	14.00	14.81	19.81	12.81	15.62	15.87	22.00	15.00	15.00	16.12	14.38	13.00	14.37	12.88	12.00	17.00	20.00	30.00	23.00	40.00	23.00
March	14.00	16.00	20.00	13.30	15.75	15.50	22.25	15.00	14.00	16.00	14.40	13.12	14.00	13.00	12.00	17.00	21.75	30.00	21.25	39.20	19.40
April	14.00	17.06	20.00	13.37	16.00	15.50	21.25	15.00	14.10	15.87	13.44	13.62	13.94	13.00	11.75	17.88	26.63	29.00	22.00	38.00	18.00
May	13.95	17.70	19.25	12.50	15.19	15.40	20.80	14.87	14.69	15.06	13.13	13.75	13.60	12.25	12.13	17.50	29.00	29.00	21.50	37.75	18.00
June	13.52	18.25	18.37	11.60	14.20	15.37	20.75	14.25	15.00	15.00	13.00	13.75	13.25	12.00	12.25	16.50	33.50	29.00	22.00	37.00	17.37
July	13.62	17.75	17.50	11.25	14.00	15.12	19.25	14.00	14.85	14.94	13.06	13.75	13.00	12.00	12.38	16.00	36.30	29.00	22.10	37.50	16.50
August	13.75	18.25	15.87	11.50	14.40	16.30	18.60	14.25	15.37	14.25	13.20	13.75	12.87	12.00	13.30	16.00	33.25	29.00	24.75	39.00	17.00
September	13.75	19.00	14.75	11.50	15.12	17.44	18.00	15.25	15.90	14.00	12.69	14.96	12.81	12.00	14.00	16.00	31.00	29.00	25.00	39.25	17.00
October	13.75	19.50	13.90	12.37	15.75	18.37	17.60	15.25	16.94	14.00	12.44	14.50	13.50	11.40	14.00	16.15	28.00	29.00	25.20	38.75	17.12
November	14.00	19.50	12.87	13.75	16.00	19.20	16.50	15.44	17.50	14.00	12.25	14.75	12.62	11.00	14.50	18.50	30.00	29.00	27.62	33.80	17.50
December	14.00	19.50	12.50	14.90	16.00	21.12	15.50	16.00	17.50	14.00	13.00	15.00	12.17	11.30	16.06	20.75	30.60	29.00	30.75	24.50	16.63
Average	*13.90*	*17.64*	*17.05*	*12.63*	*15.34*	*16.43*	*19.58*	*14.97*	*15.58*	*15.08*	*13.26*	*13.95*	*13.39*	*12.07*	*13.03*	*17.19*	*28.35*	*29.85*	*24.08*	*36.73*	*18.49*

Machine Shop Turnings—Per Gross Ton

January	$9.85	$12.95	$16.00	$8.94	$14.50	$14.50	$16.05	$ 9.00	$13.63	$14.38	$8.12	$9.00	$11.20	$7.30	$8.00	$11.13	$12.90	$19.00	$12.60	$18.75	$13.00
February	10.00	13.50	16.00	9.12	15.75	13.81	16.25	9.87	12.00	13.50	9.19	9.25	10.37	9.00	8.00	9.88	12.38	18.63	10.25	21.00	12.62
March	10.89	14.44	16.50	9.45	15.19	13.55	16.75	9.62	10.08	12.80	10.00	8.80	10.12	8.75	8.13	10.25	14.13	18.25	11.00	20.50	10.20
April	12.00	16.37	16.50	10.12	14.75	13.81	16.55	8.40	10.10	11.44	8.81	9.60	10.31	7.90	8.25	11.00	15.25	18.50	11.80	19.00	8.50
May	12.00	16.20	15.75	9.50	13.50	13.19	16.95	9.12	11.62	9.94	8.25	10.40	9.20	7.50	8.44	11.75	16.00	18.50	10.62	18.50	8.50
June	11.56	16.00	15.12	8.20	11.00	12.31	16.94	9.50	12.50	9.65	8.40	10.31	8.00	7.69	8.50	8.63	20.25	18.50	11.75	18.40	8.00
July	11.50	16.50	14.40	7.94	10.66	11.69	15.37	9.80	12.45	9.62	9.00	10.50	7.85	7.75	8.63	8.50	23.70	18.50	13.50	18.12	7.50
August	11.50	16.12	13.00	8.56	12.90	12.65	14.30	10.75	13.50	8.81	9.30	10.65	8.00	7.94	9.80	8.05	20.75	18.50	15.00	18.37	7.90
September	11.56	16.00	11.00	8.75	13.62	13.75	14.00	11.50	14.35	8.75	8.19	10.94	8.00	8.56	10.56	7.44	20.38	18.75	15.00	19.87	8.00
October	11.75	16.00	10.50	9.00	14.25	14.25	12.85	11.80	15.50	8.62	8.00	11.40	7.85	7.90	10.13	10.13	18.00	19.00	15.10	18.25	8.50
November	12.25	16.00	9.75	9.62	14.40	13.85	10.50	12.94	15.06	8.50	8.00	11.50	7.00	7.50	10.25	10.38	18.00	19.00	17.00	16.20	9.62
December	12.75	16.00	9.19	12.50	14.50	15.94	9.00	13.90	14.15	8.15	8.91	11.00	7.08	7.65	11.00	13.50	18.20	18.00	18.50	13.75	9.00
Average	*11.47*	*15.51*	*13.64*	*9.31*	*13.75*	*13.61*	*14.63*	*10.58*	*13.91*	*10.35*	*8.68*	*10.29*	*8.75*	*7.95*	*9.14*	*10.05*	*17.50*	*18.50*	*13.51*	*18.59*	*9.98*

Cast Borings—Per Gross Ton

January	$7.94	$8.00	$10.00	$6.50	$11.19	$11.00	$13.55	$7.00	$12.62	$12.22	$8.12	$8.31	$10.85	$7.80	$8.00	$11.50	$13.94	$17.00	$11.00	$22.50	$14.75
February	8.00	8.00	10.69	7.00	11.25	10.31	14.50	8.37	11.00	11.50	8.81	8.00	10.37	9.19	8.00	11.00	13.38	17.38	9.50	23.87	13.25
March	8.00	8.62	11.12	7.35	11.31	9.85	15.37	7.75	8.17	11.20	9.60	8.50	10.06	8.94	8.00	11.00	15.00	17.50	9.50	22.10	10.00
April	8.37	10.00	11.55	7.56	11.25	10.25	15.69	7.50	8.65	10.38	8.25	9.37	10.25	8.30	8.00	11.38	15.63	17.50	13.30	20.00	9.00
May	8.75	10.05	11.06	6.75	9.87	9.50	16.00	8.12	9.87	9.84	7.75	9.60	9.17	8.00	8.00	12.75	16.10	17.50	12.50	20.00	9.00
June	8.00	10.37	10.31	6.35	8.00	9.37	16.12	8.75	10.50	8.80	7.90	9.50	8.25	8.00	8.10	10.00	21.50	17.63	12.75	20.00	9.12
July	7.81	10.50	9.40	6.12	7.83	9.31	14.37	9.00	10.40	9.50	8.63	9.56	7.85	8.00	8.50	10.00	25.00	18.00	13.80	20.00	8.62
August	7.25	10.12	8.31	6.50	9.20	10.25	13.50	10.00	11.44	9.31	8.80	9.75	7.94	8.50	9.80	9.50	22.25	18.38	14.62	20.60	9.30
September	7.31	10.00	7.50	6.75	9.87	11.25	12.81	11.00	12.45	9.25	7.69	10.06	8.18	8.56	10.44	9.13	22.00	18.75	15.25	23.62	9.12
October	7.50	10.00	7.15	7.11	9.87	11.37	11.20	11.25	13.37	9.06	7.50	10.85	7.90	8.00	10.25	10.10	19.20	19.00	17.30	22.00	10.00
November	7.87	10.19	6.81	7.75	10.60	12.50	8.37	12.00	13.19	8.50	7.50	11.37	7.50	7.50	10.05	11.63	20.00	19.00	19.62	20.60	11.37
December	8.00	10.00	6.44	9.80	10.50	13.00	7.00	12.75	12.10	8.15	8.09	10.83	7.17	7.65	11.00	14.50	20.00	17.00	21.75	16.25	11.50
Average	*7.90*	*9.65*	*9.20*	*7.13*	*10.06*	*10.61*	*13.21*	*9.48*	*11.15*	*9.81*	*8.23*	*9.94*	*8.79*	*8.20*	*9.01*	*11.04*	*18.67*	*17.89*	*14.24*	*20.96*	*10.48*

No. 1 Railroad Wrought—Per Gross Ton

January	$18.00	$20.00	$22.40	$15.12	$20.75	$21.16	$22.55	$14.30	$19.50	$19.56	$15.63	$15.37	$16.10	$13.65	$12.00	$22.00	$26.60	$35.00	$24.20	$33.50	$20.00
February	18.12	21.00	22.87	15.75	21.50	19.87	21.50	15.94	17.75	18.94	16.06	14.00	15.12	14.38	12.00	21.63	25.50	35.00	21.50	36.00	19.75
March	19.50	22.50	23.25	17.20	22.37	19.20	21.12	15.31	15.00	19.00	17.20	14.12	15.25	14.00	12.50	22.13	30.75	35.00	20.25	35.90	17.20
April	19.50	24.37	23.45	17.75	22.50	20.00	20.50	15.00	15.25	18.69	16.06	15.44	15.37	13.25	12.69	23.38	36.00	35.00	21.60	35.00	17.00
May	19.00	23.60	22.50	15.75	18.75	19.20	20.60	15.00	17.12	17.50	15.25	15.75	15.00	12.63	12.94	22.50	41.40	34.00	21.00	33.50	15.20
June	18.12	23.37	20.87	13.00	16.00	17.87	20.75	15.25	18.19	16.70	15.00	15.44	14.75	12.50	13.00	20.50	51.25	34.00	21.50	33.00	14.37
July	17.50	23.00	19.40	12.69	16.16	17.50	19.12	15.95	17.45	16.00	15.13	15.50	13.90	12.20	13.44	19.50	50.60	34.00	24.40	33.00	13.50
August	18.00	23.00	17.50	13.44	18.80	19.70	18.30	17.50	18.87	15.37	15.70	15.80	14.00	12.00	14.95	20.20	45.00	34.00	26.50	33.00	14.00
September	17.87	23.75	17.00	14.45	20.50	21.25	18.00	18.25	19.95	16.10	14.75	16.31	14.68	12.38	16.50	20.00	44.00	34.00	26.50	33.25	15.00
October	18.20	23.70	16.50	15.37	21.62	22.25	17.50	18.30	20.75	16.19	13.94	16.80	14.00	11.80	16.13	21.63	37.20	34.00	26.90	29.25	15.88
November	19.75	22.50	15.25	17.00	22.70	22.25	15.75	19.19	20.75	16.00	13.85	17.06	13.00	11.50	16.50	24.13	35.00	34.00	28.37	25.00	16.00
December	20.00	22.00	14.50	19.10	21.87	23.25	14.62	19.95	19.50	15.90	15.00	16.25	12.75	11.50	20.06	26.75	35.00	33.00	30.25	20.00	14.63
Average	*18.63*	*22.73*	*19.62*	*15.55*	*20.29*	*20.29*	*19.19*	*16.66*	*18.34*	*17.16*	*15.30*	*15.65*	*14.49*	*12.60*	*14.39*	*22.03*	*38.19*	*34.25*	*24.41*	*31.70*	*16.04*

Old Carwheels—Per Gross Ton

January	$17.00	$16.95	$20.30	$12.87	$16.00	$18.75	$23.00	$18.20	$16.00	$17.50	$13.00	$12.37	$16.20	$12.20	$11.00	$16.38	$21.50	$30.00	$24.60	$36.00	$25.00
February	16.87	17.00	22.62	13.00	16.00	18.75	23.00	16.62	15.50	16.81	13.44	12.00	15.37	12.63	10.63	16.50	20.50	30.00	23.00	40.62	24.00
March	16.50	17.44	24.50	13.20	16.70	17.70	23.62	15.00	14.00	16.75	14.00	11.94	15.00	12.50	11.00	16.70	21.50	30.00	23.00	42.40	18.50
April	16.75	17.75	24.20	13.50	17.00	16.75	24.00	14.00	14.05	16.06	13.19	12.87	14.87	12.00	11.00	17.38	25.75	29.00	23.10	40.00	18.00
May	17.50	19.50	23.62	12.00	16.00	16.75	24.80	14.00	14.25	15.12	13.00	13.00	13.75	11.75	11.38	16.70	28.00	29.00	21.00	40.00	16.80
June	17.50	19.75	21.87	11.20	14.90	16.69	25.37	13.75	15.00	14.90	13.10	14.00	13.12	11.19	11.55	16.38	34.00	29.00	22.00	38.00	18.00
July	17.50	20.60	21.30	10.75	14.25	16.19	25.00	13.50	15.05	14.25	12.94	14.00	12.30	11.00	12.38	15.63	36.20	29.00	23.20	38.50	16.50
August	16.70	20.00	19.12	11.25	15.20	16.75	23.90	14.75	15.62	13.94	13.00	14.05	12.37	11.25	13.25	15.50	34.50	29.00	24.50	40.60	16.40
September	16.50	20.00	18.25	11.80	15.50	18.27	23.00	15.00	16.80	13.75	12.56	14.25	12.75	11.25	14.00	15.50	32.50	29.00	24.50	42.75	17.00
October	16.20	19.25	16.40	12.37	16.37	20.94	22.40	15.00	17.50	13.75	11.75	14.87	12.46	10.10	13.75	15.88	29.00	29.00	24.50	40.50	17.00
November	16.12	20.50	14.43	13.81	17.10	22.00	19.00	15.62	17.50	13.50	11.35	15.00	12.00	9.50	14.05	18.88	31.25	29.00	27.75	36.40	17.20
December	16.75	20.00	12.75	14.60	18.12	23.00	19.00	16.00	17.50	13.25	12.33	15.50	12.00	10.00	15.63	22.38	32.40	28.00	30.50	26.00	16.63
Average	*16.82*	*19.06*	*19.96*	*12.53*	*16.10*	*18.55*	*23.01*	*15.12*	*15.73*	*14.97*	*12.81*	*13.73*	*13.52*	*11.28*	*12.47*	*16.98*	*28.93*	*29.17*	*24.30*	*38.43*	*18.42*

Heavy Melting Steel Scrap Prices, Pittsburgh

Dollars per Gross Ton

	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921
January	$21.20	$12.50	$16.25	$17.25	$18.95	$12.80	$16.63	$17.69	$13.50	$12.75	$14.95	$10.90	$11.63	$17.50	$22.60	$30.00	$19.06	$26.30	$15.50
February	21.13	13.50	15.88	16.31	18.06	13.88	15.63	17.25	14.13	12.12	14.19	12.62	11.63	17.06	21.75	30.00	14.75	27.75	16.00
March	21.00	14.00	15.90	14.70	18.00	13.19	14.19	16.80	14.35	12.62	14.19	12.12	12.00	18.45	23.25	30.00	14.00	27.25	14.00
April	21.50	13.63	16.00	14.75	17.94	12.90	14.00	16.50	13.06	13.06	14.19	12.00	11.81	17.81	28.00	28.50	15.20	26.00	12.63
May	21.25	12.13	15.00	14.80	18.10	12.81	14.81	15.30	12.62	13.25	13.55	12.00	11.75	16.95	28.80	28.50	14.75	25.00	13.30
June	20.00	11.30	13.90	15.63	18.38	13.13	15.69	15.10	12.95	13.44	12.62	12.00	11.75	15.88	41.00	28.62	17.12	25.00	12.69
July	19.70	10.75	14.00	15.75	18.06	14.25	15.90	14.50	13.06	13.34	12.40	12.00	12.31	16.31	39.00	29.00	19.70	26.00	12.00
August	18.50	11.38	14.85	16.50	17.75	14.81	16.31	14.31	13.20	13.55	12.37	11.50	13.81	16.05	32.83	29.00	21.00	28.13	12.70
September	17.25	11.50	15.88	16.88	17.38	14.25	17.40	14.35	12.50	14.11	12.25	11.31	14.30	16.19	33.25	29.00	19.20	29.00	13.63
October	15.30	12.25	16.50	17.13	17.10	15.20	17.94	14.25	12.06	15.85	11.85	10.85	14.38	18.25	28.80	29.00	19.00	27.75	14.13
November	13.25	14.25	17.50	18.00	14.88	16.06	17.50	14.25	12.00	15.12	11.44	10.00	15.88	21.20	29.50	28.87	22.25	23.50	14.30
December	11.20	16.20	17.63	20.00	13.00	16.70	18.00	13.75	12.31	14.75	11.08	10.75	17.45	26.00	30.00	26.87	24.25	17.20	14.25
Average	*18.44*	*12.73*	*15.77*	*16.48*	*17.80*	*14.61*	*16.17*	*15.34*	*12.98*	*13.66*	*12.92*	*11.80*	*13.23*	*18.14*	*29.90*	*28.95*	*18.35*	*25.74*	*13.76*

Metals, Tin Plate and Sheets for Twenty-One Years

Lake Copper, at New York, Cents per Pound

	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921
January...	16.90	11.45	12.13	13.62	15.18	19.78	24.41	13.90	14.56	14.00	12.81	14.50	16.98	14.85	14.02	24.39	29.73	23.50	20.48	19.52	13.33
February..	16.97	12.47	12.80	13.34	15.25	17.91	25.19	13.13	13.37	13.78	12.75	14.41	15.55	15.00	15.21	26.85	34.90	23.50	17.86	19.26	13.36
March.....	17.00	12 12	14.31	12.63	15.25	18.50	23.38	12.85	12.90	13.75	12.58	14.88	15.05	14.79	15 75	27.10	35.85	23.50	15.46	18.67	12.84
April.....	17.00	11 97	14.85	13.19	15 18	19.62	24.62	13.09	12.94	13 31	12.41	16.00	15.67	14.75	18.90	28.27	31.67	23.50	15.55	19.36	12.77
May.....	17.00	12.10	14.75	13.28	15.00	18.70	24.19	12.88	13.21	13.06	12.33	16.30	15.91	14.40	21.00	28.88	31.42	23.50	16.18	19.05	12.96
June.....	17.00	12.23	14.56	12.74	15.00	18.60	23.94	13.00	13.50	12.88	12.71	17.53	15.42	14.12	23.38	27.82	32.46	23.50	17.95	19.00	12.91
July.....	16.97	11.94	13.73	12.63	15.03	18.47	21.95	13.00	13.34	12.66	12.78	17.54	14.78	13.70	21.98	25.84	28.78	25.80	22.07	19.00	12.60
August.....	16.50	11.59	13.35	12.50	14.97	18.65	18.94	13.71	13.56	12.93	12.75	17.73	15.86	12.85	19.33	26.95	27.24	26.00	23.16	19.00	12.00
September.	16.50	11.60	13.58	12.67	16.13	19.31	16 41	13.80	13.50	12.81	12.65	17.77	16 77	12.66	17.97	28.03	24.90	26.00	22 68	18 70	12.20
October ...	16 71	11.71	13 42	13.00	16 63	21.81	13 80	13.81	13.19	12.84	12.53	17.80	16.85	11 73	17.89	28.48	23.50	26.00	22 13	16 56	12.95
November.	16.82	11.44	13 25	14.22	16.99	22.53	13.94	14.44	13.44	12.98	12.80	17.70	16.16	12.00	18.92	32.32	23.50	26.00	20.60	14.67	13.33
December .	14.71	11.61	12.30	14.87	18.75	23.06	13.48	14.53	13.80	13.00	13.84	17.69	14.88	13.35	20.24	33.38	23.50	25.40	18.90	13.90	13.77
Average .	*16.67*	*11.86*	*13.39*	*13.06*	*15.86*	*19.89*	*20.34*	*13.51*	*13.44*	*13.17*	*12.75*	*16.65*	*15.82*	*13.69*	*18.72*	*28.19*	*28.95*	*24.68*	*19.43*	*18.06*	*12.89*

Spelter, at New York, Cents per Pound

	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921
January...	4.08	4.28	4.82	4.95	6.17	6.48	6.90	4.54	5.15	6.26	5.55	6.52	7.15	5.29	6.59	18.19	9 94	7.88	7 38	9.62	5.83
February..	3.94	4.18	5.00	4.95	6.12	6.09	7.00	4.78	4.99	5.89	5.56	6.71	6.45	5.40	8.84	20.13	10 48	7.99	6.70	9 14	5.36
March.....	3.89	4.20	5.36	5.05	6.06	5.96	6.92	4.76	4.81	5.72	5.65	6.98	6.26	5.28	9.29	18 40	10.77	7 64	6 52	8.93	5.20
April.....	3.94	4.41	5.65	5.22	5.97	6.05	6.81	4.68	4.94	5 60	5 51	6 86	5.77	5 18	11.22	18 58	9.85	7.01	6 51	8.63	5.24
May.....	3.97	4.50	5.75	5.14	5.55	5.95	6.51	4.60	5.12	5.20	5.50	6.88	5.47	5 06	16.14	15.86	9.46	7 32	6.46	8 08	5.28
June.....	3.95	4.88	6.00	4.79	5.33	6.14	6.45	4.56	5.30	5 19	5.63	6 99	5.18	5 09	22.18	12 75	9 62	8 01	6.93	7.92	4.95
July.....	3.90	5.23	5 95	4.85	5.34	5.98	6.15	4.46	5.35	5.20	5 79	7 26	5.38	5 02	20 58	9 83	8 95	8 60	7.90	8 18	4 77
August....	3.93	5.48	5.94	4.85	5.65	6.05	5.71	4.71	5 74	5.26	6 04	7 19	5 75	5 00	14.11	8.98	8 69	8.96	7 84	8 31	4.69
September.	4.02	5.45	6.00	5.06	5.93	6.19	5.23	4.76	5.85	5 53	6 03	7.53	5 82	5 50	14 16	8 22	8.34	9 60	7 57	7 82	4.74
October ...	4.20	5.48	6.05	5.17	6.05	6.18	5.45	4.81	6.09	5.69	6 20	7 57	5 42	4 97	13 96	9 98	8.24	9 11	7 83	7.51	5.10
November.	4.32	5.20	5.68	5.49	6.17	6.36	5.10	5.03	6.32	5.95	6 60	7 48	5 29	5.12	17.15	11.90	7.95	8.70	8 14	6.84	5.18
December .	4.35	4.91	5.15	5.83	6.53	6.61	4.33	5.17	6.35	5.80	6.44	7.33	5 18	5.71	16.69	11 13	7.84	8.45	8.59	6.00	5.25
Average .	*4.04*	*4.86*	*5.81*	*5.11*	*5.90*	*6.17*	*6.06*	*4.74*	*5.51*	*5.61*	*5.88*	*7.11*	*5.76*	*5.27*	*14.24*	*13.66*	*9.18*	*8.28*	*7.36*	*8.08*	*5.13*

Lead, at New York, Cents per Pound

	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921
January...	4.37	4.02	4.10	4.39	4.58	5.85	6.39	3.73	4.19	4.70	4.59	4.41	4.35	4.11	3.74	5.93	7.69	6.87	5 56	8 67	5.00
February..	4.37	4.10	4.10	4.40	4.53	5 55	6.31	3.75	4.07	4.63	4.46	4.00	4.35	4.06	3.82	6 23	9.13	7.04	5.05	8 88	4.54
March.....	4.37	4.10	4.44	4.50	4.45	5 35	6.31	3 88	4.02	4 51	4.41	4.08	4.35	3.97	4.04	7.43	9.47	7.24	5.23	9 21	4.08
April.....	4.37	4.10	4.59	4.50	4.53	5.39	6.16	4.02	4.19	4.40	4.44	4.20	4.40	3.82	4.20	7.73	9.43	6 95	5.03	8.95	4.33
May.....	4.37	4.10	4.37	4.48	4.50	5 90	6.02	4.26	4.32	4.37	4.40	4.20	4.37	3.90	4.25	7.45	11.00	6.88	5 05	8 55	4.99
June.....	4.37	4.10	4.25	4.22	4.51	5.94	5.75	4.45	4.36	4.38	4.46	4.50	4.35	3.90	5.89	6.87	11.68	7.55	5.34	8.48	4.56
July.....	4.37	4.10	4.12	4.17	4.56	5 80	5.24	4.50	4.35	4.40	4.50	4.67	4.37	3.90	5.59	6.34	10 72	8.04	5 65	8 67	4.40
August....	4.37	4.10	4.12	4.15	4.64	5.78	5.12	4.59	4.36	4.40	4.50	4.54	4.64	3.87	4 68	6.26	10.72	8.05	5.77	8 98	4.40
September.	4.37	4.10	4.26	4.20	4.85	5.92	4.84	4.54	4.39	4.40	4.49	5 04	4 73	3.86	4.62	6 88	8.84	8.05	6 12	8 11	4.60
October ...	4.37	4.10	4.40	4.23	5.07	5.94	4.64	4.34	4.39	4.40	4.31	5 06	4.52	3.52	4.60	7 00	6.77	8.05	6.45	7 24	4.70
November.	4.37	4.10	4.25	4.51	5.48	5.97	4.45	4.39	4.40	4.44	4.31	4.65	4.33	3.68	5.16	7.13	6.44	8.05	6.76	6 33	4.70
December .	4.19	4.10	4.19	4.60	5.95	6.19	3.76	4.24	4.56	4.50	4.45	4.32	4.06	3.80	5.33	7.60	6.48	6.71	7.03	4.80	4.70
Average .	*4.36*	*4.09*	*4.27*	*4.38*	*4.80*	*5.80*	*5.41*	*4.22*	*4.30*	*4.48*	*4.44*	*4.47*	*4.40*	*3.87*	*4.68*	*6.90*	*9.03*	*7.46*	*5.76*	*8.07*	*4.58*

Straits Tin, at New York, Cents per Pound

	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921
January...	26 60	23.38	27 76	28 75	29.13	36.35	42.14	27.43	28.19	32.61	41.20	44 58	50.34	39.12	34.13	41 76	44.10	85.13	71.50	62 74	35.94
February..	26.55	24.73	29.14	27.98	29.49	35.48	42.16	28.74	28.44	32.65	43.34	43.56	48.71	39.82	37 25	42.60	51.47	85.00	72.45	59 87	32.16
March.....	25.95	26.16	30.06	26.19	29.21	35.62	41.29	30.46	28.75	32.51	41.10	42.76	46.93	38.03	48.73	50.53	58.38	85.00	72.50	61 93	28.79
April.....	25.94	27.29	29.60	27.99	30.43	38.86	40.84	31.79	29.35	32.83	42.05	43.64	49.04	36.10	47.64	51 51	55.82	88.53	72.50	62 12	30.36
May.....	26.82	29.26	39.26	27.76	30.04	43.05	43.01	29.84	29.07	33.05	43.32	45.98	49.05	33.21	38.79	49.14	63.21	100.00	72.50	54 99	32.50
June.....	28.22	29.29	28.30	26.14	30.36	43.97	42.65	28.18	29.26	32.79	46.25	47.44	45.01	30.60	40.26	42.07	61.93	91.00	71 83	48 34	29.39
July.....	27.41	28.28	27.60	26.28	31.71	37.18	41.15	28.92	29.05	32.99	43.23	44.70	41.32	35.65	37 38	38.25	62.61	93.00	70 11	49 29	27.69
August....	26.90	28.14	28.00	26 74	32 85	39.93	37 35	29.99	29.95	33.92	43.38	45.86	41.63	48 34	34.37	38.88	62.53	91.33	62.20	47 60	26.35
September.	25.04	26.55	27 06	27.27	32.21	40.32	37.22	28.91	30.00	35.17	39.69	49.16	42.63	31.13	33 13	38.65	61.54	80.40	59 79	44 43	26 70
October ...	24.62	25.76	25.83	28 53	32.47	42.90	32.33	29.44	30.41	36.76	41.23	50.07	40.38	30.25	33.05	41.10	62.24	78.82	54 82	40 47	27.70
November.	27.47	25.43	25 35	29 00	33.46	42.70	30.81	30.43	30.74	37.38	43.03	49.87	39.75	33.28	39.50	44.12	74.18	73.67	54.17	36 97	28.93
December .	24.39	25.33	27.53	29.27	35.84	42.62	27.92	29.13	32.91	38.21	45.03	49.86	37.12	34.01	38.53	42.55	84.74	71.51	53.80	34 04	32.41
Average .	*26.38*	*26.03*	*28.80*	*27.66*	*31.44*	*39.67*	*38.24*	*29.44*	*29.68*	*34.24*	*43.74*	*46.46*	*44.33*	*35.80*	*38.56*	*43.43*	*61.90*	*89.28*	*65.68*	*50.23*	*29.91*

Tin Plate, at Pittsburgh, Dollars per Box

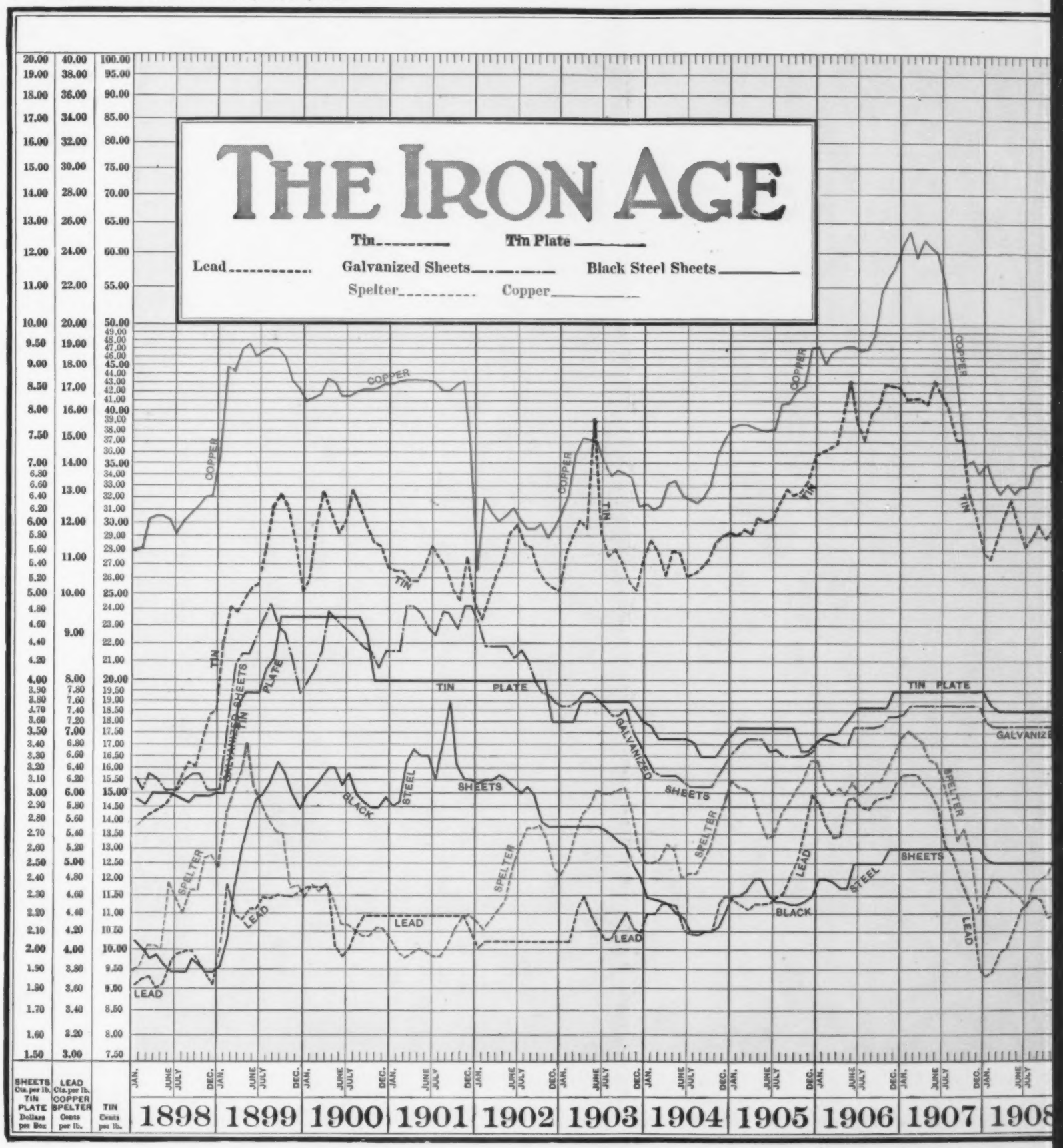
	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921
January...	$4.00	$4.00	$3.60	$3.56	$3.55	$3.47	$3.90	$3.74	$3.70	$3.60	$3.60	$3.40	$3.60	$3.32	$3.10	$3.75	$7.00	$7.75	$7.35	$7 00	$7.00
February..	4.00	4.00	3.60	3 45	3 55	3.50	3.90	3.70	3.70	3.60	3.67	3.35	3.60	3.29	3.10	3.96	7.38	7.75	7.35	7 00	7.00
March.....	4.00	4.00	3.80	3.45	3.55	3.51	3.90	3.70	3.53	3.60	3 70	3.30	3.60	3.30	3.25	4.19	8.00	7.75	7.26	7.00	7.00
April.....	4.00	4.00	3.80	3.45	3 55	3.57	3.90	3 70	3.40	3.60	3.70	3.30	3.60	3.30	3.25	4.50	8.00	7.75	7 00	7.00	6.44
May.....	4.00	4.00	3.80	3.45	3.55	3.65	3.90	3.70	3.40	3.60	3.70	3.33	3.60	3.30	3.15	5.30	8.40	7.75	7 00	7 00	6.25
June.....	4.00	4.00	3.80	3.45	3.55	3.75	3.90	3 70	3.40	3.60	3.70	3.40	3.60	3.30	3.11	5.81	10.50	7.75	7 00	7 00	6.25
July.....	4.00	4.00	3.80	3.41	3 55	3.75	3.90	3.70	3.40	3.60	3.70	3.43	3.60	3.27	3.10	6.00	12.00	7 75	7.00	7 50	5.69
August....	4.00	4.00	3.80	3.30	3.55	3.75	3.90	3.70	3.40	3.60	3.70	3.50	3.55	3.41	3 10	5.95	11.40	7.75	7.00	9.00	5.25
September.	4.00	4.00	3.80	3.30	3.55	3.75	3.90	3.70	3.40	3.60	3.67	3.58	3.50	3 35	3.15	5.75	12.00	7 75	7.00	9.00	5.25
October ...	4.00	4.00	3.80	3 30	3 34	3.75	3.90	3.70	3.50	3.60	3.52	3.60	3.50	3.24	3.15	5.81	.....	7.75	7 00	8.33	5.13
November.	4.00	3.60	3.65	3.39	3.34	3.90	3.90	3.70	3.56	3.60	3.40	3.60	3.40	3.15	3.28	5 97	7.75	7 75	7.00	7.50	4.75
December .	4.00	3.60	3.60	3.47	3.40	3.90	3.90	3.70	3.60	3.60	3.40	3.60	3.40	3 13	3.52	6.63	7.75	7.55	7.00	7.00	4.73
Average .	*4.00*	*3.96*	*3.74*	*3.48*	*3.50*	*3.69*	*3.90*	*3.70*	*3.50*	*3.60*	*3.68*	*3.45*	*3.55*	*3.28*	*3.19*	*5.30*	*9.11*	*7.73*	*7.08*	*7.63*	*5.90*

No. 28 Black Sheets, at Pittsburgh, Cents per Pound

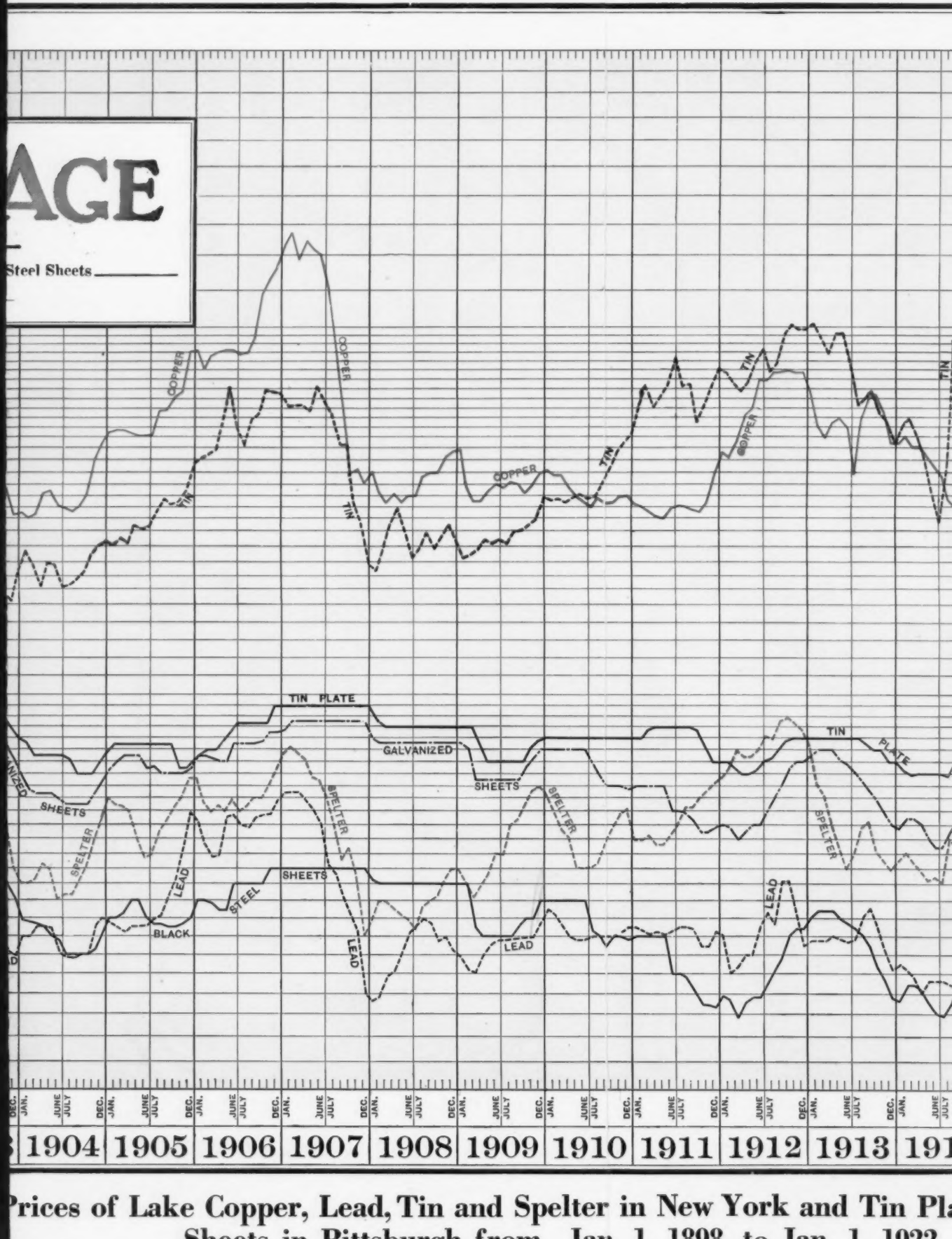
	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921
January...	2.99	3.08	2.75	2.29	2.30	2.40	2.60	2.52	2.50	2.40	2.20	1.90	2.31	1.87	1.80	2.60	4.50	5.00	4.70	4.48	4.35
February..	2.94	3.10	2.75	2.28	2.30	2.40	2.60	2 50	2.50	2.40	2.20	1.87	2.35	1.95	1.80	2.60	4.69	5 00	4.70	5 00	4.21
March.....	3.23	3.10	2.75	2.27	2.34	2.38	2.60	2.50	2.25	2.40	2.20	1.80	2.35	1.95	1.80	2.71	4.94	5.00	4.61	5 50	3.88
April.....	3.35	3.13	2.75	2.25	2.40	2.35	2.60	2.50	2.20	2.40	2.20	1.86	2.35	1.91	1.80	2.85	5.75	5.00	4.35	5 50	3.88
May.....	3.39	3.10	2.75	2.20	2.40	2.35	2.60	2.50	2.20	2.40	2.20	1.90	2.30	1.85	1.79	2.89	7.00	5.00	4.35	5.50	4.00
June.....	3.30	3.05	2.75	2.16	2.30	2.50	2.60	2.50	2.20	2.40	2.00	1.90	2.27	1.81	1.75	2.90	7.88	5.00	4.35	5.50	3.80
July.....	3.10	3.00	2.74	2.10	2.26	2.50	2.60	2.50	2.20	2.24	2.00	1.95	2.25	1.80	1.75	2.90	8.50	5.00	4.35	6.75	3.31
August....	3.41	3.05	2.70	2.10	2.26	2.50	2.60	2.50	2.20	2.21	1.99	2.02	2.21	1.86	1.85	2.90	8.50	5.00	4.35	7 50	2.90
September.	3.78	2.98	2.65	2.10	2.25	2.50	2.60	2.50	2.26	2.13	1.91	2.07	2.14	1.95	1.90	2.93	8.50	5.00	4.35	7 38	2.81
October ...	3.23	2.79	2.62	2.10	2.25	2.50	2.60	2.50	2.30	2.20	1.85	2.21	2.04	1.94	2.03	3.23	.....	5.05	4.35	6.69	3.00
November.	3.10	2.75	2.49	2.13	2.27	2.60	2.60	2.50	2.30	2.20	1.85	2.25	1.97	1.87	2.25	3.65	5.00	5.00	4.35	5.77	2.86
December .	3.10	2.75	2.32	2.22	2.30	2.60	2.60	2.50	2.40	2.19	1.84	2.25	1.89	1.82	2.50	4.31	5.00	4.85	4.35	4.35	3.00
Average .	*3.23*	*2.99*	*2.67*	*2.18*	*2.30*	*2.47*	*2.60*	*2.50*	*2.29*	*2.20*	*2.04*	*2.00*	*2.20*	*1.88*	*1.92*	*3.04*	*6.29*	*4.99*	*4.43*	*5.85*	*3.50*

No. 28 Galvanized Sheets, at Pittsburgh, Cents per Pound

	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921
January...	4.36	4.64	3.70	3.36	3.35	3.45	3.67	3.59	3.55	3.50	3.20	2.90	3.46	2.87	2.79	4.75	6.25	6.25	6.05	5.33	5.70
February..	4.36	4.36	3.70	3.25	3.40	3.45	3.75	3.55	3.51	3.50	3.20	2.87	3.50	2.95	3.16	4.75	6.38	6.25	6.05	6 50	5.56
March.....	4.84	4.36	3.78	3.23	3.45	3.43	3.75	3.55	3.26	3.50	3.20	2.80	3.50	2.95	3.40	4.75	6.69	6.25	5.96	7 00	5.05
April.....	4.84	4.36	3.89	3.23	3.45	3.40	3.75	3.55	3.25	3.50	3.20	2.86	3.50	2.91	3.29	5.00	7.00	6.25	5.70	7.00	4.88
May.....	4.74	4.36	3.88	3.23	3.45	3.40	3.75	3.55	3.25	3.50	3.20	2.90	3.42	2.80	3.50	4.94	8.20	6.25	5.70	7.00	5.00
June.....	4.59	4.23	3.81	3.18	3.35	3.55	3.75	3.55	3.25	3.50	3.00	2.90	3.38	2.75	4.28	4.69	9.50	6.25	5.70	7.00	4.88
July.....	4.48	4.26	3.73	3.14	3.36	3.55	3.75	3.55	3.25	3.39	3.00	3.00	3.33	2.75	4.40	4.38	10.00	6.25	5.70	8.25	4.31
August....	4.74	4.18	3.66	3.14	3.32	3.55	3.75	3.55	3.25	3.30	2.99	3.12	3.24	2.85	3.71	4.21	10.00	6.25	5.70	9.00	3.90
September.	4.73	3.99	3.66	3.14	3.30	3.55	3.75	3.55	3.28	3.21	2.93	3.21	3.16	2.95	3.56	4.18	9.75	6.25	5.70	8.88	3.81
October ...	4.55	3.87	3.73	3.14	3.30	3.58	3.75	3.55	3.35	3.20	2.85	3.36	3.08	2.95	3.50	4.41	.....	6.25	5 70	8.18	4.00
November.	4.84	3.85	3.51	3.23	3.32	3.65	3.75	3.55	3.43	3.20	2.85	3.40	2.98	2.88	3.89	5.18	6.25	6.25	5.70	7.04	3.86
December .	4.84	3.78	3.40	3.31	3.35	3.65	3.75	3.55	3.50	3.19	2.89	3.40	2.90	2.78	4.75	6.00	6.25	6.15	5.70	5.70	4.00
Average .	*4.66*	*4.19*	*3.70*	*3.22*	*3.37*	*3.52*	*3.74*	*3.55*	*3.34*	*3.37*	*3.04*	*3.06*	*3.29*	*2.87*	*3.69*	*4.77*	*7.84*	*6.24*	*5.78*	*7.24*	*4.58*



Fluctuations in Carload Prices of Lake Copper, Lead, Tin Sheets in Pittsburg



Prices of Lake Copper, Lead, Tin and Spelter in New York and Tin Pla
Sheets in Pittsburgh from Jan. 1, 1898, to Jan. 1, 1922

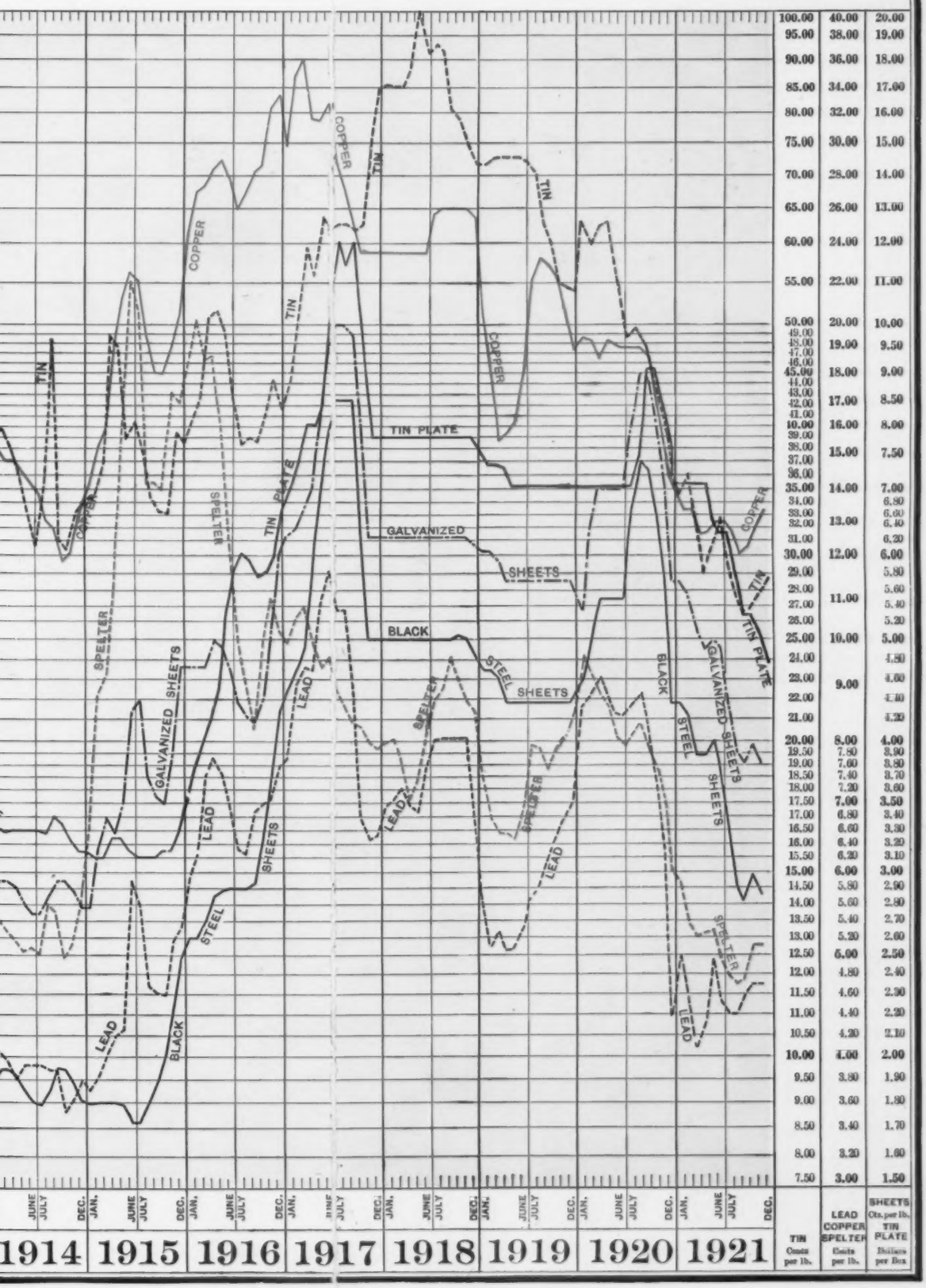


Plate and No. 28 Black and Galvanized
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(*Continued from page 56*)

car builders did not become a factor until relatively late in the year, when heavy railroad car orders were placed. The automobile industry was a small buyer this year, although it did account for the movement of some iron during two relatively short periods. During April and May, some of the foundries serving the automobile industry became more active, but this activity consisted principally of the shipment of finished castings on which they had not yet received releases from the car manufacturers. In the latter part of July, August and September, there was a fair amount of buying of iron by foundries of this class. The most prominent purchasers of the year were manufacturers of sanitary ware, plumbing goods, heating apparatus and other household appurtenances. The American Radiator Co., the Standard Sanitary Mfg. Co., United States Radiator Co. and Kohler and Rundle in Wisconsin were among the companies of this class which bought frequently throughout the year. This activity was accounted for by dwelling house construction, which was stimulated by high rents.

From the first of the year until Aug. 1 there was a steady reduction in pig iron production in the Chicago district and output did not again start to increase until early in October.

Resale iron was a factor in this market in January and February, but by the end of the first quarter had largely been absorbed. While the decline in prices was uninterrupted until early in August, there was a moderate revival in business in March, April and May. The leading merchants, Pickands, Brown & Co., reported that their shipments in March were 30 per cent larger than in February, that April shipments were 30 per cent greater than those of March and that May shipments were 40 per cent larger than April. June and July, however, were exceedingly dull months. When the last Pickands, Brown furnace went out, the Inland Steel Co., which had been selling merchant iron throughout the year, advanced its prices and considerable business was closed at the old quotations on the eve of the advance. At the end of August, Inland again advanced its prices to $21, forcing in considerable business at the old quotation of $20. Early in September, it made a third advance to $22, but this was not effective. The first break in the market resulted from the unloading of speculative tonnage bought by a broker at the old price of $21. By Nov. 15 the price had dropped still lower to $20 base and in December there was a further recession to $19.

Average Monthly Pig Iron Prices, f.o.b. Valley Furnace, Per Gross Ton, 1921

	Bessemer	Basic	No. 2 Foundry	Gray Forge
January ...	$32.00	$30.00	$31.875	$30.875
February ..	29.00	27.50	28.00	27.00
March	26.20	24.20	25.70	24.70
April	25.00	22.875	24.75	23.75
May	24.20	22.00	23.40	22.40
June	22.75	20.75	21.875	20.875
July	20.875	19.375	20.125	19.125
August	20.00	18.20	19.90	18.90
September...	20.00	19.125	21.00	20.00
October	20.00	19.1875	21.00	20.00
November...	20.00	19.00	20.70	19.70

Average Monthly Prices of Pig Iron Delivered Philadelphia or Vicinity in 1921

	Basic Del'vd Eastern Pa.	Standard Low Phos.	Gray Forge	Virginia 2X
January ...	$33.51	$42.62	$32.77	$40.49
February ..	30.65	41.50	31.15	37.24
March	26.15	41.50	26.86	34.59
April	25.00	38.75	25.26	32.99
May	25.00	38.00	25.26	32.99
June	24.62	38.00	24.69	32.99
July	22.37	38.00	22.50	31.86
August	19.70	36.80	21.20	29.94
September...	19.19	36.50	20.00	28.49
October	20.50	36.50	20.50	28.24
November...	20.70	36.50	22.50	28.24
December...	20.62	34.87	21.69	28.24

Buffalo Iron Down to $19.50

In the twelve months just closed Buffalo prices sagged from $32.50 base—the ruling quotation Jan. 1, 1921—to $19.50, the present market. Furnace operation picked up materially in the closing weeks of the year. The minimum operation was touched in July, when only three stacks were in blast out of a complement of 22. Nine stacks are now going. The lowest price the Buffalo market reached was $18.50, but this concession was only in special instances when radiator interests came into the market for unusually large tonnages.

Foundry and Scrap Prices, Cincinnati, 1921

	Southern Foundry No. 2	Northern (So. Ohio) Foundry No. 2	No. 1 R.R Wrought (Net Ton)	No. 1 Machinery Cast (Net Ton)
January ...	$36.50	$33.77	$11.50	$17.75
February ..	32.63	32.02	11.50	15.50
March	29.80	29.92	11.10	13.90
April	28.50	28.27	10.00	13.50
May	27.00	27.02	10.00	13.50
June	26.20	25.72	9.60	13.10
July	24.88	23.92	8.50	12.00
August	23.50	22.52	8.50	12.00
September...	23.50	23.12	8.50	12.80
October	23.50	23.52	9.00	14.00
November...	22.90	22.72	9.00	14.00

Coke Reverses Preceding Year's Record

Light Demand, Low Prices and Small Production Natural Results of Reduced Operation of Blast Furnaces

THE coke market in 1921 reversed its 1920 course. Instead of a demand well in excess of supply, which carried prices to the highest levels attained since coke production began on a commercial scale, there was always a sufficient supply and prices descended to the most reasonable bases in several years. The coke business usually is either a feast or a famine with the Connellsville producers. They enjoyed a "feast" in 1920, but in 1921 they had to put up with very lean times. Not a factor which contributed to the 1920 conditions remained in 1921. Steel companies operating their own by-product coke plants were not forced in 1921, as they were in the previous year, to depend on the beehive ovens, for a goodly part of their coke requirements, due to Fuel Commission regulations, which made it difficult to secure coal for their by-products plants; nor in the year just ended did the steel companies have transportation difficulties to defeat their coke producing efforts, and export demands were lacking as an excuse for pushing up the price of coal.

As a matter of fact, the coke requirements of the steel companies were moderate in the extreme last year, because of the subnormal demand for steel and some of them having by-product plants actually became commercial producers of coke, not having a sufficient number of blast furnaces in operation to absorb the production. Merchant producers of pig iron were not pressed for tonnages and the number of such furnaces in blast rarely in recent years has averaged as low as in the past year. Only one merchant furnace in the Pittsburgh and nearby districts was in blast throughout the entire year, and this stack, one of the two operated by the American Manganese Co., Dunbar, Pa., oddly enough, runs on by-product coke, that company operating a Semet-Solvay installation. In late June, not a merchant blast furnace in the Mahoning and Shenango valleys was in blast and at the end of the year only three of the 14 merchant furnaces in that district were making iron. Operations of furnaces in other districts usually served from Connellsville ovens, also were low last year.

Greatly Reduced Production

The records, as compiled by *The Connellsville Courier*, indicated a production for 1921 of less than 3,400,000 net tons, or less than one-third of the output of the previous year and the ton value of last year's

production was less than one-third of that of the previous year, calculating on the average price for the whole year. The average price of spot or prompt Connellsville furnace coke for 1921, based on the weekly prices of THE IRON AGE, was $3.32 per net ton at ovens. The highest price of the year, which was made early in January, was $5.50. The 1920 average price of this grade was $11.32, while the peak price was $19. The descent in foundry coke prices in 1921 was in like ratio, although the demand for this grade relatively was better than that for furnace fuel, because the foundries averaged a slightly better relative operation than did the blast furnaces. The average price for spot or prompt Connellsville foundry coke for 1921, was $4.63 per net ton at ovens, which compared with $13.10, the 1920 average, while the top price in 1921 was $7, as compared with $20 in 1920.

Wage Reductions

There were several wage reductions during the year which materially reduced the costs of the Connellsville mine and oven operators, but they did not avail much in producing profits because never during the year was there very full mine or coke oven operations. The wage scale now in effect is that posted by the H. C. Frick Coke Co., effective Aug. 1, last. This schedule is the same as that of Nov. 10, 1917, of the same company. Independent operators for a time were paying a lower scale, but the threat of a strike and possible unionization of the district resulted in their adoption of the Frick scale, which, as compared with those unionized coal mining districts, gives the Connellsville operators a decided advantage as to costs. It is because of this advantage that the results for 1921 were not worse than they were, since it permitted the naming of prices on coal with which operators of union mines could not compete, and Connellsville coal moved to a number of markets not usually reached.

Not a Prosperous Year

Last year was not a prosperous one either for the by-product coke oven operators. Most of the steel companies having such plants operated at as low a rate as possible, without injury to the ovens, for they did not need much coke with many blast furnaces idle. Commercial by-product plants had to keep going to meet gas requirements and the coke had to be sold cheaply, if at all. In the East, Connellsville coke was available usually at a delivered price well below that quoted by the by-product coke plants, which were at a decided disadvantage by reason of the high freight rates on coal.

There was a little change during the year in the relative standing of the by-product and beehive oven capacity. Few beehive ovens have been abandoned, while costs did not decline sufficiently to encourage additions to the number of modern coking plants. There are built and building in this country, 11,628 by-product coke ovens capable of producing annually 44,000,000 net tons of coke. Such a tonnage would have exceeded the total 1921 requirements and it also is patent what a large percentage of the country's needs now can be supplied from by-products plants when it is recalled that the maximum production in one year of both by-product and beehive oven coke was 56,000,000 net tons. iThis considerably exceeds the country's normal annual requirements, which, if it became necessary, probably could be accommodated by the by-product plants alone.

Improving demand for pig iron during the past few weeks gives rise to hopes of the early blowing in of a number of blast furnaces, but there were no indications of such developments in the coke market in the closing weeks of 1921. Only a few contracts, for furnace coke, were under negotiation and these were for the first quarter requirements of furnaces now in blast. The gain in active blast furnaces since the low point of last July assures production to meet such increase in demand as has lately developed.

Connellsville Coke Prices for 18 Years

1921	Prompt Furnace	Prompt Foundry
January	5.0625	6.375
February	4.50	5.625
March	4.35	5.45
April	3.50	4.75
May	3.25	4.50
June	3.00	4.45
July	2.8125	4.0625
August	2.75	3.75
September	3.15	4.15
October	3.275	4.375
November	3.03	4.19
December	2.75	3.8125

Safe Prices for Semi-Finished Steel

Lack of Activity in Bars Affects Adversely Consumption of Billets—Large Spread Between Billets and Rods

SHEET bars stood out last year as the most active form of semi-finished steel in a market which, generally, was decidedly subnormal in respect to demand, in keeping with the market for finished products. Not a few users of bars have the facilities for rolling them from billets and in ordinary times find it cheaper to buy the billets than the bars. Similarly, not a few makers of tubular goods, lacking the facilities for making steel, are equipped to convert slabs into skelp, and as a rule buy the slabs. Over much of the past year bars and skelp have been available at rather less money than they could have been made for at the prices which ruled for billets and slabs. A slow and uninteresting market in these forms of steel, therefore, has been an altogether natural condition. Since most commercial producers of semi-finished steel also have finishing capacity, it is also natural that they should have tried to secure as much business in finished products as possible, not only to secure the finishing profit, but to avoid the condition of being obliged to sell the semi-finished material so cheaply as to have this recoil against them in the shape of competition on the finished products. The situation with regard to sheet bars differs from that in billets and slabs in that the makers of sheets and tin plate, lacking steel making capacity, have no intermediate product to draw on as bolt and spike manufacturers or the makers of tubular goods. That sheet bars should have shown the lead in activity, therefore, is not surprising.

Little Buying of Bars

The lack of real activity in merchant mill products such as hot-rolled flats—hoops, bands, cotton ties and strips—affected adversely the consumption of billets, but the heaviest loss in billet tonnage is directly chargeable to the very low ebb to which the buying of merchant steel bars fell in the past year. There was only limited buying by the agricultural implement manufacturers who felt heavily the contraction in buying by the farmers, who in 1921 were not better off financially than they were the year before. Railroad buying of bars amounted to little and the automobile industry was less a factor than before in several years. The automobile makers carried over rather heavy tonnages from 1920 into 1921 and even when these stocks were used up, they were careful to gage purchases by requirements. Demands upon the makers of cold-finished steel bars and shafting were light throughout the year and this affected the consumption of hot-rolled bars and, in turn, billets. Inactivity in slabs reflected the relatively light demand, taking the year as a whole, in pipe and plates. If it were not for a brisk rally in the fall in the price of crude oil, consumption of slabs would necessarily have been smaller than it was, for

the appreciation in oil prices brought out late in the year some rather good orders for line pipe and for oil storage tanks. Trading in forging steel was limited and sporadic. The automobile industry was a sparing buyer of forgings; there was little business from the implement manufacturers or the railroads and the low rate of shipyard activities also told heavily on the demand.

Demand for Wire Rods Curtailed

Every use to which wire rods are put was restricted in 1921. Wire products suffered by reason of the light demand from the agricultural regions, which usually take 50 per cent or more of the total output of the mills. Chain makers were not crowded with business, nor were the makers of screw stock or rivets.

Prices of semi-finished steel were soft throughout the year and attempts to either stem the downward movement or to establish an advance proved even more futile than did those in finished materials. This was because producers did not always have orders sufficient to absorb production and the non-integrated manufacturers exerted a good deal of pressure on prices to get the unfinished steel cheaply enough to be able to compete in the market in finished products. Sheet bars declined from $47 in January to $29 in September and the latter price was not exceeded on much tonnage during the remainder of the year. In the September effort at price stabilization, when sheet prices were advanced $5 a ton, the quotation on sheet bars was put up to $32, but just as the consumers of sheets were allowed to enter orders at the old prices, sheet makers who buy their bars were given a chance to cover their requirements at the old basis. Another advance in sheets was attempted in early October and at the same time an effort made to put sheet bars to $34, but the effort was a dismal failure and since it was followed by a decline in sheets to even below the early September bases, the price ideas of buyers of sheet bars declined accordingly.

The market at the end of the year was $29 to $30, Pittsburgh or Youngstown, this price showing a decline for the year of $17 to $18 per ton or about 38 per cent. Soft billets dropped from $43.50 in January to $29, and the latter was the basis of such business as was done in the closing weeks of the year. This was a decline of about 35 per cent for the year. Forging billets fell from $48.50 to $32 or about 34 per cent and wire rods from $57 for the base size to $38, a decline of $19 a ton, or one-third of their January, 1921, value. As compared with 1913, the last normal year prior to the war, soft billets now show an advance of only $3.21 per ton on the average price of that year, while rods at $38 are $9.60 per ton above the 1913 average. The spread between billets, and rods in the 1913 average was $2.61 per ton; to-day it is $9 and this presents a condition that sooner or later must find correction.

Average Monthly Prices on Semi-finished Steel, 1921
Pittsburgh

	Billets		Sheet Bars		Wire Rods
	Bessemer	Open-Hearth	Bessemer	Open-Hearth	
January	$43.50	$43.50	$47.00	$47.00	$57.00
February	41.00	41.00	44.50	44.50	54.50
March	38.40	38.40	39.70	39.70	52.00
April	37.50	37.50	38.50	38.50	49.00
May	37.00	37.00	39.00	39.00	48.00
June	37.00	37.00	34.25	34.25	48.00
July	32.25	32.25	31.20	31.20	42.75
August	29.60	29.60	30.00	30.00	41.60
September	29.00	29.00	30.00	30.00	39.50
October	29.00	29.00	30.00	30.00	40.50
November	29.00	29.00	30.00	30.00	40.00
December	29.00	29.00	30.00	30.00	38.00

Plates, Shapes and Bars Dull

General Disposition to Abandon Pittsburgh Basing Point—Reduced Operations of Many Consumers

THE steel industry last year had its first taste of the effects of the war time expansion in capacity for rolling the heavy tonnage products, and is hoping fervently that 1922 is not going to repeat the dose. With capacity for caring for very much greater tonnages of plates, shapes and bars than were wanted, it is merely stating the obvious, in observing that competition for business constantly waxed keener, not only between mills in the several producing centers, but actually between the centers themselves. In the latter part of the year, there was an open abandonment of the Pittsburgh base in the quotations of mills, both East and West, and indeed, on the part of at least one Pittsburgh company, which undertook the delivery of steel products by the inland waterways and took orders on a delivered instead of an f.o.b. Pittsburgh base, with an idea of offsetting the freight rate advantages enjoyed by Western mills on Western and Southwestern business, when the latter began billing f.o.b. mill or f.o.b. Chicago. Buffalo mills, while the New York State barge canal was open to navigation, largely controlled the Eastern market by quoting delivered prices, New York, which, because of the low canal freight rate, were well below those named by mills, either in Pittsburgh or observing the Pittsburgh base. In passing, attention should be drawn to the fact that manufacturers using the inland waterways for shipments wisely quoted a delivered price instead of a mill base, and adding the water freight rate. To have adopted the latter plan instantly would have focussed the attention of the railroads on the question and possibly might have resulted in an upward revision of the water rates. The competitive conditions of the year, of which the use of the waterways was one result, accomplished what Western consumers of steel for several years have been agitating, the abolition by law of Pittsburgh as a sole basing point of steel prices. As a matter of fact, there is never, except when it will best serve their purposes, very rigid observance by the manufacturers outside of Pittsburgh of the Pittsburgh base, but non-adherence is not usually as open as it was during the latter part of 1921. While the tendency to quote an f.o.b. mill or a delivered price embraced almost all steel products, it was more pronounced in plates, shapes and bars than in the other lines.

Previous Period of Stagnation

With regard to the demand for these major steel products, it is necessary to go back to that period of stagnation which ruled just before and after the beginning of the world war, as the last previous time when manufacturers experienced such lean times as they did last year. The early part of 1919, following the signing of the armistice, was dull, but there was a recovery which was broad and rapid in that year, while in 1921 business was good only for a period of about eight or ten weeks, roughly, from about the first of September until the middle of November. During the first eight months of the year, consumers were chiefly concerned in reducing the large stocks carried over from 1920, and since this process was slow and laborious, new buying was both sporadic and small. There was very little industrial construction, because expansion in this direction during the war was so great that the country's requirements for the next few years at least, had been anticipated. The obstinate position of the building trades in refusing to go along with the economic and industrial readjustment, while it did not entirely stop new office and other structural work, undoubtedly prevented the placing of much more work of this sort than actually was placed. It was not the cost of the steel, its fabrication or erection, that prevented the placing of structural work, for steel prices declined 40 per cent during the year and even more as compared with the 1919 peak prices, while there were projects in several parts of the country against which the fabricating shops contracted to furnish, fabricate and erect the steel

at prices around $60 per ton, which was approximately the price for work of a like character before the war.

Work of Fabricators

According to the compilations of the Bridge Builders and Structural Society, all of the fabricating shops of the country for the 11 months ended Nov. 30, had taken orders aggregating 686,800 tons. With the country's fabricating capacity over 180,000 tons a month, the business for the 11 months would have been sufficient to keep the shops running full for less than four months. These facts bracketed with the large stocks carried over from 1920, picture graphically the causes for the lowest operation structural mills have had in a number of years. Structural beams started the year at 2.45c., Pittsburgh, and ended at 1.50c., and this price not infrequently at mill instead of Pittsburgh. While attractive tonnages usually were stipulated, it became the practice of mills toward the end of the year to regard orders for 400 or 500 tons as "attractive."

Railroads Repair Rather Than Build

The railroads were not important factors in the demand for structural material. They repaired rather than built new bridges. They were not directly, or indirectly, heavy buyers of plates and bars at any time during the year, although they did create some business for the plate mills in the repairs to equipment they started after the July 1 wage cut became effective, and later provided a fair amount of plate business by ordering some new cars, the details of which are given elsewhere in this issue. It was the oil industry, through its pretty constant orders for storage tanks, which provided the best outlet of plates during the year. Incidentally, the fabricating in transit privilege was freely exercised in connection with tank orders and this resulted in an abnormal placing of the plate orders. Mills located much further away from the fabricating plant frequently were able to underquote nearby mills by reason of having a lower through rate to ultimate destination. Demand of the shipbuilding industry for plates were small to the point of being trifling. There was no Government building of merchant steamships during the year and little private construction on either the coast or the lakes. The largest order that came out in Cleveland was 3200 tons and this was for repair work. Warship building brought no new business and much tonnage ordered now may be cancelled in the event the naval construction holiday is approved by the various nations represented at the disarmament conference in Washington. Plate mill capacity expanded more than any other class of mills during the war and this contributed in no small measure to the weakness of prices during the year. Plates were quoted at the beginning of 1921 at 2.65c. Pittsburgh. At the close of the year they could be bought at 1.50c. f.o.b. Pittsburgh, f.o.b. Chicago or f.o.b. mills. Plate mill operations in all parts of the country were low during most of the year but because of the increase in number it is possible the output may show well by comparison with pre-war records on a fewer number of units.

Limited Buying of Bars

Steel bars suffered in demand because of the subnormal requirements of the agricultural implement makers, the railroads and the automotive industry, which ordinarily account for the great bulk of consumption. The automobile makers carried over large stocks and though they enjoyed a couple of spurts of good business, they got along without finding it necessary to make big purchases. Railroads waited until labor became more reasonable before doing any buying and then they bought sparingly. The implement makers again were confronted with the problem of trying to find business among buyers without money. Two successive years of low prices for farm products made the financial position of the farmers so bad they simply had to make their old tools do. A Chicago hard steel bar plant, dependent almost entirely upon the implement industry, was shut down in December, 1920, and since has not turned a wheel. Bar mill activities like those in plates and shapes, rarely were good during the year, and the competition for business was so keen that, like plates and shapes, bar prices drifted away from a Pittsburgh base. The common price in Pittsburgh, Chicago, Cleveland, Buffalo and other points of production at the end of the year, was 1.50c. At that price f.o.b. Pittsburgh, bars were below the 1913 average and if prices in other markets are reduced to the Pittsburgh equivalent, there is a price as low as 1.12c., deducting the freight of 38c. per 100-lb. from Pittsburgh to Chicago. That is very close to the extreme low point of pre-war times. If pre-war prices are the ultimate goal of buyers, bars have not far to go and as bearing on the future course of the market it must be noted that bars are more fully deflated than probably any other steel product.

Lean Year for Wire Products

Low Prices of Farm Products Have Marked Effect—Efforts to Stimulate Business

HISTORY was made last year in wire products. For the first time on record, an attempt to advance prices by means of the usually successful formula of first intimating an early advance and then allowing buyers to cover for 60 or 90 days at the prevailing prices, was a dismal failure. This happened early in November, when the American Steel & Wire Co. and some of the independents notified their customers of an impending advance, but expressed a willingness to take contracts for two or three months at the "regular" quotations of $2.90 base per keg, Pittsburgh, for nails and $2.60 base per 100-lb., Pittsburgh, for plain wire. In September such an effort had been fairly, but not wholly, successful. In August, business, which previously, since the beginning of the year, had grown progressively worse, began to increase and with orders, notably from jobbers, coming in fairly freely, the time was considered ripe to attempt a price stabilizing effort. Accordingly most of the manufacturers advised the trade that as of Sept. 12, there would be an advance from $2.75 per keg for nails to $2.90 and in plain wire from $2.50 to $2.60; in cement coated nails from $2.35 per count keg to $2.45 and in galvanized wire from $2.95 to $3.10, and galvanized barbed wire from $3.40 to $3.55. The American Steel & Wire Co., which initiated the movement, secured more than 300,000 tons of business as a result of the lifting of quotations and a number of the independents also secured substantial contracts covering the ensuing 60 and 90 days. All makers of wire products did not follow the advance, the Youngstown Sheet & Tube Co. being one of them, and some of those who made the advance failed to get many contracts.

Inasmuch as the business secured on the drive was at the old and lower levels, and that some companies never departed from these prices, the new quotations were the basis of little or no business. This is easily understood when it is repeated that all companies did not share alike in the business which came out in September and the customers of those that had the lightest bookings would be put at a disadvantage with those of the more successful manufacturers if obliged to pay the new prices. Moreover, there still remained the companies which did not make the advance. All that resulted from the advance was that distributors were able to get a larger profit, since they, of course, based resale prices on the new mill bases, although covered on supplies at the old prices.

It was to give basis to the quotations $2.90 for nails and $2.60 for wire that the November drive for orders

was started. With steel prices generally showing a downward slant at that time, jobbers and consumers could not see the justification in an advance in wire products and accordingly failed to respond. Some contracts were made at $2.90 for nails and $2.60 for wire, but being on the basis of an advance which was to follow, they became only "scraps of paper" when the advance did not take place. If there were any shipments against these contracts, they did not carry higher prices than $2.75 for nails or $2.50 for wire and in a broad way those were the maximum prices obtained during the last half of the year. The market grew weak in December, when wire dropped to $2.25 base per 100-lb. and there was considerable shading of $2.75 for nails, forced by the action of some of the smaller makers in quoting on a mill instead of a Pittsburgh base, and thus giving buyers the advantage of savings in freight. On Dec. 15, prices were dropped $5, making wire nails $2.50 and plain wire $2.25.

As was true of almost all steel products, there were several attempts during the first half of 1921 to stabilize prices of wire and wire products, but it invariably happened that no sooner were prices set up as "regular" than that they were toppled over by some makers who needed orders. In the April stabilization movement when the Steel Corporation lowered its prices and independent prices were advanced, nails were put at $3.25 base per keg, Pittsburgh, and wire at $3 base per 100-lb., Pittsburgh, but these prices were not long maintained and a drop of $5 per ton, which came a few weeks later, was followed by another of the same amount, before business began to pick up in August.

It was a lean year both in business and profits. Prices over most of the year were soft and this fact, as usual, made for cautious buying, while financial distress in the agricultural regions largely cut off the most important outlet for wire products. The farmers did not have the money to buy fence or wire because there was no money in their crops in 1921 and following the disastrous results of 1920, their credit with the banks was impaired. The makers of fence did everything possible to stimulate business. As early as July they were giving November datings on orders and later they gave guarantees against a decline in prices, running up to the spring of 1922. But neither effort helped much. Nails were the most active wire product, and they, as far as profits go, are to manufacturers as sugar is to the corner grocer. There are hopes that 1922 is going to be much better than 1921, but few expect better business until the second quarter, because the farming population hardly will be buyers before then, while nails, being essentially a building necessity, can not well move freely until the weather is open enough to permit such work. As compared with other steel products, excepting only sheets, wire products at current prices have made relatively less progress back to normal pre-war prices and this may have some bearing on the 1922 demands.

Decreased Demand for Sheets and Tin Plate

Automobile Industry Not as Important a Factor as in 1920—Many Tin Plate Mills Idle

THE story of the sheet market in 1921 does not vary much from that in other steel products. Independent manufacturers, who in 1920 enjoyed highly prosperous times, with a large production sold at high prices, in 1921 experienced neither a large business nor profits. Indeed, if the estimates of producing costs have either value or basis, the prices which prevailed during most of the year must have forced incursions into the surplus accounts built up in 1920. A number of mills, notably those of the American Sheet & Tin Plate Co., were kept fairly busy by a pretty constant demand for light gage black sheets from Japan and some demand for this kind of stock also came from European countries. It was not particularly satisfactory business, since it was of the tin mill gages and dimensions and it was so costly to produce that several makers who shared in the business later regretted that they had. However, the business was something of a backlog and helped to keep some capacity going when domestic business was light and hard to get.

Domestic business was considerably below normal, taking the year as a whole, and it was really small by comparison with that of 1920. There was a good demand for sheets used for building purposes and those engaged in the building of railroad cars were relatively good buyers of corrugated galvanized sheets for car roofs and ends. The latter demand, however, was less in connection with new cars than in the repairs to old ones. The automobile industry was not nearly the factor in the market in 1921 it was in the year before, but the tonnage that industry purchased in 1920, as has been pointed out frequently before, was greatly magnified by the fact that there are so few manufacturers who can make sheets of the kind used in automobile bodies, fenders, cowls, hoods, etc., and also because the desire for rush shipments created a stir far greater than warranted by the actual business placed. It was an even lighter year for the makers of such sheets than it was in the automotive industry itself, for the reason that the automobile makers almost without exception, carried over pretty big supplies and in those periods when business was good they did not have to make many or large new purchases. Electrical sheets were dull throughout the year, not only because the slump in the demands upon makers of automobile starting and lighting systems but because it was a dull year for the makers of motors generally. Jobbers evidently carried over pretty large stocks from 1920, because they evinced little interest in the market until late in the year.

Declining Price Tendency

The tendency of prices throughout the greater part of the year was down and until the last month or so efforts to check the decline or to stabilize prices met with little success. The beginning of the year found all makers quoting a uniform basis of 4.35c. for black, 5.70c. for galvanized and 3.55c. for blue annealed sheets. These were the prices which the Steel Corporation subsidiary had observed throughout 1920, and indeed from March 21, 1919. The independents found it impossible late in 1920 to do business at above these bases and they found out early in 1921 that they could not get business at those prices. The Steel Corporation enjoyed a business in January that permitted it to keep 90 per cent of its mills running. With independents averaging less than a third of the rate, it was only natural that such an uneven division of the business should have aroused them to action. And it did. Early February saw price cutting by the independents to secure orders and thereafter until September prices were weak under open market competition. Even in September, when prices were advanced $5 a ton or from 2.75c. to 3c. for black, 3.75c. to 4c. for galvanized, the gain to the mills was in orders rather than in money returns, for preceding the advance buyers were given ample time to cover at the old prices. When another advance of $5 per ton was attempted in early October, it not only failed but was followed by a fresh decline, carrying prices even lower than they had been prior to the September advance. The October attempt at putting up prices failed because so many requirements were filled on the September drive and also because it came before the September advance was established.

From Nov. 25, when the American Sheet & Tin Plate Co. opened its books for first quarter and first half of 1922 business, and named 3c. base for black, 4c. base for galvanized and 2.25c. base for blue annealed, on first quarter business, the market showed marked firmness on those bases. Business was slow but all makers seemed tired of taking business at a loss and these prices were well observed. The American

Sheet & Tin Plate Co., which profited none by the high prices of 1920, had to go along with the decline in 1921 to hold its trade, but it did have the satisfaction of having a relatively better average operation of its mills than the independents, and also of turning out a higher proportion of its potential capacity than the outside companies.

There were only trifling additions to sheet mill capacity during the year, and these were entirely by the independents, who made a net gain of about 20 mills, counting 8 new mills of the Republic Iron & Steel Co., at Niles, Ohio, and 10 new mills at the new plant of Follansbee Bros. Co., at Toronto, Ohio. The Apollo Steel Co., Apollo, Pa., added to its capacity, but there was some dismantling of units by others.

Tin Plate Market Was Disappointing

The tin plate market for 1921 was a disappointment, as following two light years, last year was expected to be good. If production was as much as 50 per cent of normal capacity, it will be a big surprise. There was not the demand in the first place and secondly, labor troubles kept a number of plants idle for several months, and in one instance for the entire year. These troubles affected mills which previously had been operated under an agreement with the Amalgamated Association of Iron, Steel and Tin Workers, and came as a result of an effort to establish "open shop" working conditions. Three of the five companies finally signed up with the association and got going in the fall after being down since June 1, while the other elected to fight out the issue.

The demand for tin plate for perishable food was good in connection with the pack of peas and for condensed milk, which got fairly well back from the distressful conditions of 1920, where the over-production of the war time period was bearing down heavily on the industry. The pack of tomatoes and other vegetables was low and there was almost no pack of salmon, although 1921 was a year of a good run of these fish. Oil can and general line requirements were good but could have been better. Packers generally underestimated their requirements and there were a good many hurry-up orders after the vegetable packing season had started. The mills, lacking production orders, made up a good deal of tin plate and this put the market on more of a spot than a contract basis over a good deal of the year.

Prices began the year at $7 per base box, dropped to $6.25 in April, to $5.75 in July and to $5.25 in August, to $5 in October and finally to $4.75 in November, this latter price being the official quotation of the American Sheet & Tin Plate Co., effective Nov. 3, and applying to all shipments after that date.

Oil Well Demand for Pipe

New Field in Texas is Developed—Year Begins and Ends With Cuts in Steel

THE year began, and it might almost be said, ended with a price reduction in steel pipe, for on Dec. 15, the National Tube Co. issued new cards which lowered the price of standard or merchant pipe $5 per ton, oil country tubular goods by a like amount and line pipe $6 per ton. The first day of the year 1921 saw the issuance by several independent makers of steel pipe, of new cards, which reduced their prices to the levels which the leading interest steadily had observed from March 21, 1919. Throughout 1920, the independent cards had shown advances of $7 to $10 per ton over the National Tube Co. quotations, but the actual sales prices during most of that year had only remote relation to the card quotations. High prices in 1920 were largely, if not wholly, due to the demands of the oil industry. The collapse of the oil market late in that year cut sharply into the demands upon all makers, but hit the independents hardest since the bulk of their bookings was at prices well above those of the National Tube Co. Shrinkage of independent order books forced the revision in independent prices back to the level of the leading producer and this change came on or about Jan. 1, 1921. Four other changes, all reductions, came during the year, with the National Tube Co. usually taking the lead in putting out new cards, but only because its cards, though always adopted by the independents, soon after issue became obsolete, as selling bases, owing to the competition for business.

First Change in April

The first change in steel pipe discount cards came April 8, when the Mark Mfg. Co. issued a card increasing the discount 5 points, thus cutting the price $10 per ton, putting the base size of black butt weld pipe at 62½ per cent off list. This reduction was not met by other independents or the National Tube Co. and the card was withdrawn, when as of April 13, the latter issued its first new card since March 21, 1919. This card made reductions of from $4 to $10 a ton in black butt weld standard pipe, and $4 to $12 a ton in galgalvanized butt weld in the sizes ¼-in. and larger and of $8 to $10 per ton in lap weld standard pipe. Corresponding reductions were made in oil country and line pipe. This card also made some changes in size groupings, ⅛ in. being set up as a separate size; formerly it had been bracketed at the same discount as ¼-in. pipe, and the base sizes of butt weld pipe, previously, from ¾-in. to 3-in. were changed to 1-in. to 3-in. This new card was part of an effort at steel price stabilization, which crystallized in uniform quotations by both the independents and the Steel Corporation on all steel products, this move bearing a date of April 12.

Cards Disregarded

Observance of the April 13 steel pipe card soon grew lax, and on July 7 it was supplanted by a new one, which lowered standard pipe $2 to $4 per ton on the butt weld sizes and $4 to $6 a ton on lap weld sizes, while oil country pipe was lowered $4 to $7 a ton. This change merely affirmed publicly prices which previously had been made quietly. The July 7 cards remained effective for an even shorter period than the preceding one, for on Sept. 16 new schedules appeared, which made a cut almost as deep as that of April 13. The Sept. 16 cards reduced butt weld sizes of standard and line pipe $8 a ton and lap weld sizes $8 to $10, with oil country goods declining to about the same extent. This card also changed the size brackets on large diameter lap weld pipe; previously 7-in. to 12-in. pipe took the same discount, while in the Sept. 16 card 7-in. to 8-in. pipe and 9-in. to 12-in. pipe were set up at separate discounts. Business in steel pipe, which had steadily declined during the first seven months of the year, improved in August along with other steel products, but not nearly to the extent of providing all manufacturers with more than part capacity operations. The upward slant of demand continued during the remainder of the year, with real activity appearing in line pipe, due to a rally in the price of oil and the opening up of the new Mexia field about 75 miles southwest of Dallas, Tex. Despite the improvement in business, however, there still was not enough to go around and there continued to be application of the stimulant of concessions from the established or regular prices. Price cuts in line pipe were particularly severe, sales of 4-in. pipe being made in November as low as $44 per net ton, Pittsburgh, at a time when merchant pipe of the same size was quoted at around $70 per net ton.

Disparity in Prices

On the ground of producing costs there is little excuse for such a disparity. The actual cost difference size to size, between merchant and line pipe, largely is in the fact that the coupling for line pipe must be heavier and stronger than the merchant pipe coupling.

and consequently more costly. But there is usually more tonnage per order of line pipe than in merchant pipe and the former being more desirable from the manufacturers' standpoint, there naturally is keener competition for business. The cutting of regular prices was not confined to line pipe, however, there being instances where the supplementary discounts, on merchant pipe, to large jobbers instead of the regular one point and 5 and 2½ per cent off, went as high as two full points, or 70½ per cent off list for the base sizes. This condition forced the new card, dated Dec. 15, previously referred to.

The end of the year found the card discount on the base sizes of merchant steel pipe at 71 per cent off list, as against 57½ per cent as of Jan. 1, a rise in the discount of 13½ points, the equivalent of a reduction of $27 per ton. The year, as a whole, was an unsatisfactory one, especially when contrasted with 1920, when the market purely was a sellers' affair, while last year the advantage was with the buyer. Caution was the keynote with buyers throughout 1921, but this augurs well for 1922, since it means relatively light stocks in jobbers' and consumers' hands. This year gives promise of considerable oil well development, since oil prices are back upon a profitable basis and it also promises well for merchant pipe because there remains a shortage of housing to be partly made good in the next twelve months.

Welded Iron Pipe

The story about wrought iron pipe with respect to business is similar to that of steel pipe. There was the same transition from stout to lean order books in the early part of the year and a gradual gain in the last four or five months. Price revisions in wrought iron pipe have been as frequent as in steel pipe, there being one March 1, another April 13, another July 7, and the last one Sept. 1. The first change was a cut by the Reading Iron Co., which canceled about one-half of the advance made by that company in December, 1920. This change put the principal makers of iron pipe on the same basis of prices. The April 13 reduction was $6 to $12 a ton on standard black pipe and $6 to $14 a ton on galvanized. In July iron pipe prices were cut $8 to $12 per ton, or just double the reduction made at that time in steel pipe. On Sept. 1 came another cut, this time of $10. The base discount on black wrought iron pipe stood at 25½ per cent off list Jan. 1; on Dec. 31 it was 44½ per cent, this being equivalent to a drop of $36 a ton for the year.

Spread Between Iron and Steel

There has been very little narrowing of the spread between steel and wrought iron pipe during the year. It was a matter of $64 a ton in favor of steel at the beginning of the year, and at the end of the year amounted to $63 a ton, these figures being calculated on the base sizes of black butt weld pipe. This price advantage for steel pipe is a real hardship for makers of wrought iron pipe, in competition with steel pipe, and apparently there is little likelihood of a change in the price relation of the two kinds, because the manufacture of iron pipe involves much hand labor which does not gain in efficiency or cheapness, as do the mechanical means employed to an ever-increasing extent in the manufacture of steel pipe.

Uneventful Year in Old Material

Low Rate of Operations at Metal Working Plants Reflected in Dull Market for Scrap

IN a year in which iron and steel production was at the lowest point in many years, the demand for scrap was also at a minimum. The year was uneventful in every respect. Price tendencies were downward, with the exception of brief periods in May and again in the early fall when a slight gain in operations among steel plants, foundries, iron rolling mills, etc., created a better demand and an upward movement in prices.

While the net decline in the price of heavy melting steel, delivered in the Pittsburgh district, was only a little over $1 a ton during the year, other grades declined much more. For example, No. 1 cast at Pittsburgh dropped from $25 to $16. In other districts, there were similar declines. Heavy melting steel for delivery at eastern Pennsylvania steel plants was quoted at $14.50 early in January and at $11.50 in late December.

During the year, production of scrap naturally fell off because of the low rate of operations at most metalworking plants and much of the scrap offered for sale came from the railroads. In the monthly sales of railroad scrap, the bids put in by consumers were frequently higher than those quoted by dealers and brokers, hence a good deal of the railroad material passed directly into the hands of its users.

The low prices reached in mid-year attracted the speculative interest of both dealers and consumers and considerable scrap was accumulated. Some steel plants have sufficient stocks in storage to last for two or three months, at least, even though a better rate of operations is reached in the first quarter of the year than has been possible during 1921. Scrap dealers have accumulated old material at varying prices, some having started to buy speculatively before the bottom of prices had been reached. The effect of this will be to withhold these accumulations from sale until prices have reached a point where a good profit can be had. Some dealers have heavy melting steel in their yards which has cost them about $15 or more a ton and obviously will not dispose of it until prices have reached what to them is a profitable basis.

The Pittsburgh scrap market showed its greatest weakness in April, June and July. In April, dealers seemed to tire of guessing where the bottom was and, having tied up a good deal of money in yard stocks, withdrew from the market. Steel orders, accumulated on the price stabilization effort of April 12, caused some improvement in scrap demand in May, but it was short-lived and the market turned weak in June and July. Improvement in the steel business and in steel works' activities after the middle of July filtered through to the scrap market in August, and thereafter until about the middle of November there was fairly well-sustained buying of the steel works grades. The steel mills of the Pittsburgh district had a fairly good run of business between Sept. 1 and Nov. 15, but as it was low-priced, effort was put forth to keep down costs of production, and this was largely achieved by increasing the melt of scrap. The highest prices paid for steel scrap came early in the year. Steel companies figured more heavily in the tonnages bought than foundries, few of which, with the exception of those making castings for sanitary ware, were at all well engaged. The end of the year found many yard dealers carrying large stocks, bought at prices which would net a loss if sold below $17. While railroad lists were fairly heavy each month, offerings of industrial scrap were light. The automotive industry was a relatively small producer of scrap in 1921.

Eastern Pennsylvania Market Inactive

During a greater part of the year the demand for scrap from eastern Pennsylvania steel plants, and likewise from other metalworking industries which melt scrap, was very small. Many consumers took advantage of the situation to pick up their requirements from offers which in the terms of the trade are classed as "forced sales," and one steel company, though not operating its plate mills for a considerable part of the year, accumulated a large store of steel in small lots and this scrap it still has in readiness for the time when an increased steel production requires its use. Two or three plants which run entirely or very largely on a scrap mixture were fairly consistent buyers

throughout the year, but the grades they use are chiefly stove plate, railroad grate bars, borings and turnings. Only during a short time in the fall was there a fairly active scrap market in the Philadelphia district, and after that show of strength the market lapsed into weakness which continued up to the end of the year. If any point is worthy of special emphasis regarding the 1921 scrap market, it is that production of scrap as well as consumption fell far below normal. Scrap dealers regard the available supply as inadequate for any quick revival in steel production. Since the low prices were reached six months or so ago, dealers have been bullishly inclined and strongly of the opinion that prices will advance with some rapidity on the first dependable showing of improved business conditions in the iron and steel industry.

Much of the supply of borings and turnings naturally flows from New England to the Pittsburgh and eastern Pennsylvania steel-making districts, but during 1921, production in metalworking plants was so low that the supply of borings and turnings was exceedingly limited, this causing spurts of strength in these grades at various times during the year.

Cleveland Scrap Market

The Cleveland scrap market probably suffered more from the depression during 1921 than any other consuming center in the country, owing to the very limited operation of Cleveland mills. From being an important consuming center of scrap from outside producing points, Cleveland had to find an outside market for much of its scrap, a large share of which went to Valley mills, Canton, Weirton, and the Pittsburgh district. Previously, Cleveland mills had consumed much of the scrap produced at the Detroit automobile plants, but other outlets had to be found for the Detroit scrap, much of it going to Valley mills. The absence of a local demand resulted in unusually low scrap prices in Cleveland, as scrap sold for outside shipment had to carry a freight rate, and the lowest freight rate to an outside consuming point was $2.10. The activity during the year was confined largely to heavy melting steel and blast furnace borings and turnings. Cleveland iron rolling mills bought no scrap during the year and sales of cast scrap were very light.

One Cleveland mill purchased considerable heavy melting steel to lay down in its yard and little of this has, as yet, been consumed. Some of this was bought at $10, delivered, and the highest price paid was $13. Prices on heavy melting steel ranged from $14 to $14.75 at the opening of the year, but settled down to about $10.50 to $11 in June, and in December had worked up to $11.50 to $12.

Chicago Scrap Market in 1921

During 1921 there were four speculative advances by Chicago scrap dealers, only one of which, however, was of long duration. Toward the end of January dealers bought railroad material freely and advanced their prices, but this boom quickly burst early in February, following which there was a continued drop in prices until the end of April, when dealers again commenced to bid against each other for railroad material and laid in stocks in their yards in anticipation of subsequent buying by consumers. This advance continued until the end of May, when the market broke again. Declines proceeded throughout June and July, prices reaching the low point of the year in July. In the last week of July the dealers again took heart as a result of two good-sized steel purchases by mills. All through August, September and October the dealers continued to lay in stocks at advancing prices and sold some material to consumers at the rising quotation. Toward the end of October, however, the prospect of a railroad strike tended to weaken the market and distress tonnage was sold at reduced prices. During the middle of November the market advanced again, but soon broke, and at the end of 1921 prices were again declining.

Average Monthly Prices for Leading Grades of Scrap, Per Gross Ton, Delivered, Pittsburgh

1921	Heavy Melting Steel	No. 1 Cast Cupola	Bundled Sheets	Machine Shop Turnings	Cast Iron Borings
January	$15.50	$25.00	$11.00	$10.00	$13.00
February	16.00	22.75	11.00	10.00	12.00
March	14.00	21.20	10.30	9.40	11.45
April	12.625	18.00	9.00	8.125	9.375
May	13.30	18.00	9.00	8.70	9.70
June	12.6875	16.625	8.25	7.5625	8.375
July	12.00	16.00	8.00	7.00	7.625
August	12.70	16.20	8.60	7.85	8.30
September	13.625	16.875	9.375	9.0625	9.00
October	14.125	17.50	10.375	9.5625	10.125
November	14.30	17.10	10.80	9.85	10.40
December	14.25	16.13	10.50	8.88	9.25

Postponed Buying of Cast-Iron Pipe in 1921

Municipalities Frequently Re-advertised Because of Declining Market —More Sales Than in 1920

THE rapid liquidation of cast-iron pipe prices during 1921 caused a year of unusual uncertainty for both producers and buyers. Municipalities continually advertised for bids, only to reject them and re-advertise later, when the chances were they would receive lower offers. Prices declined approximately 33 1/3 per cent during the year—more specifically, 25 per cent in the East; 33 per cent in the Chicago district; and 38 per cent in the Birmingham district. Gray forge pig iron fell about 31 per cent in the same period.

The first of the year saw general reductions in pipe foundry labor, averaging 20 per cent; pig iron began a gradual descent; however, pipe prices did not respond to the lower making costs until the middle of the year when the drop came suddenly. From the middle of May until the last of August, prices in New York fell from $63.30 to $42.30 for the 6-in. size. Two weeks later, they were raised about $5 a ton and continued at that level the remainder of the year.

Compared with other iron and steel industries, the year for the pipe makers was excellent. Only one line of iron and steel manufacture rivaled it—those engaged in the manufacture of heating equipment, such as radiators, stoves and boilers. It was reported from Chicago at the middle of November that the "tonage booked to date this year compares favorably with that taken during the entire previous year." Figures from two thirds of the plants of the United States show total bookings up to Dec. 1, 1921, of close to 280,000 tons as compared with 285,000 tons for the entire year of 1920.

Such a heavy demand was natural. During the war the price of pipe had been so high and labor so scarce that municipalities and private companies had postponed, where possible, the making of pipe line extensions. The past year witnessed not only greatly reduced prices, but a super-abundance of labor. Much of the pipe bought in 1921 was largely to give work to the unemployed in the various communities. Hindrances to sales were the high freight rates, the difficulties of some municipalities to float bonds and the receding prices which caused a postponement. One city in the Central South signed a contract for the purchase of 6000 tons of pipe. When it realized the freight was $30 per ton, it canceled the order. Heavy tonnages were shipped by boat to the Pacific Coast by Southern makers out of Mobile, the freight rate being $14.13, as compared with an all-rail rate of $31.70. A delivery was made from a New Jersey shop to Texas by water more cheaply than it could have been made by rail from a Birmingham district shop.

There were practically no irregularities in the operation of the railroads, such as the embargoes of the year before. The only approach to transportation trouble was the threatened railroad strike in November which caused a deluge of rush shipment orders on the part of purchasers, as well as the bringing in of a few fresh orders in anticipation of a railroad tie-up.

The high freight rates encouraged the use of wooden or steel pipe, whish came into competition more keenly than usual. For instance, a Missouri city purchased wood pipe; a city in Michigan asked for 5000 tons of pipe, inviting bids on wood and steel, and eventually buying 1000 tons of steel and the remainder, cast-iron; in December an up-New York State city considered seriously the purchase of 6000 tons of steel pipe, which was lower-priced, but decided on cast-iron. Cast-iron pipe, as compared to wood, is an exceedingly heavy commodity per foot, as is observed when the freight is paid.

At the first of the year we reported that: "Business has fallen very flat. Plants with old orders are running at perhaps 25 per cent capacity; other plants are shut down completely. Buyers of pipe are waiting for pig iron market to become stabilized." About the first of February many of the shut-down plants had re-opened. Operations continued in increasing volume and at the middle of April we reported that "Pipe is the one commodity in the iron and steel industry for which there is a full-fledged demand." In December the demand was still considerable, being greater than normal for that season of the year.

Present momentum will carry the buying movement well into 1922. Many pipe laying jobs are being planned for the spring. At the close of the year, the oil companies, liberal purchasers but for some time dormant, came into the market again for flanged pipe and will continue in 1922. To keep pace with the building movement water systems will be extended; smaller pipe will have to be replaced with larger sizes; municipalities that postponed purchases will finally close. The year ahead appears promising.

Non-Ferrous Group Marking Time Most of the Year

Copper Strong at the Close—Sharp Liquidation in Tin—Steady Demand for Lead—Zinc at Pre-War Levels

AFTER a year of readjustment, lagging demand and curtailment in output—a year generally acknowledged as one of the worst on record—the major non-ferrous markets enter the new year strong in sentiment and firm in prices. The last two months of 1921 were the bright spots in a very drab year, for in those months buying was the largest of the year and the price tendency decidedly higher.

Eventful Year in Copper

The year just closed has been one of the most eventful in copper annals. Aside from the depression, which has been one of the most pronounced on record, there were three developments of marked importance: Closing down of the mines, financing of stocks of refined copper for export and foreign demand, particularly from Germany.

Late in March came the decision of the porphory mining companies and the Anaconda Copper Mining Co., as well as others, to curtail operations completely or to the vanishing point. It was recognized that costs of operation were suicidal and that nothing else was left to be done. This resulted in a reduction of mining to about 40,000,000 lb. per month. By December active preparations had been made to resume mining on a much larger scale.

About the middle of February there was announced the successful financing of large stocks of copper, involving the sale of debentures up to $40,000,000 against 400,000,000 lb. of copper, all to be held for export and not sold at less than 12.50c. per lb. The market price of electrolytic copper at that time was 13.25c. delivered.

In foreign demand the year was phenomenal, with Germany the leading purchaser, followed by France, Great Britain and Japan in the order named. To Nov. 1 Germany had bought more copper than the other three countries combined and had taken over 40 per cent of the total exports.

The year's price trend was not erratic. Opening at 12.75c., New York or refinery, electrolytic copper fell to 11.37½c., refinery, on Aug. 26, rising intermittently after that to 13.62½c., refinery, at the close of the year, or the year's highest, with prospects of a continued advance. Buying, as well as inquiry, for the metal from domestic sources was active in the later weeks and the year closed with the market firm and statistically and technically strong.

Severe Drop in Straits Tin

Straits tin sank to the lowest levels in many years when it was quoted at 25.50c., spot delivery, New York, on Aug. 25. The high for the year was 38.75c. in January. From the low point there was a gradual advance to the end of the year, when the market closed strong and moderately active around 33c.

The principal feature of the year was the complete liquidation that took place, probably the most severe of any of these markets. A comparison with other years will demonstrate this. The average price of spot Straits tin, New York, in 1913 and 1914 was 44.33c. and 35.80c. respectively, and in 1920 it was 50.23c. The low point for 1921 was therefore down to half of the 1920 average, with the year's closing price of about 33c. under the 1914 average. To find a lower average it is necessary to go back to 1909, when it was 29.68c.

The year as a whole was a quiet one, with sales the lowest in many years. Not until late in the year was there any active interest from consumers. In November there were periods of old-time active buying, caused largely by the increased operations in the tin plate industry, due to an unusual demand for tin plate and depleted stocks of the metal in consumers' hands. Imports of tin were the lowest in many years.

Lead a Steady Market at Pre-War Levels

The lead market has been the most consistently strong and steady of any of the markets. There have been no features of any description. The prominent fact has been that demand has been moderate but fully equal to production and that they have about balanced each other throughout the year.

In prices the metal has ranged practically between 4c. and 5c., New York, or virtually at pre-war levels. The year's high was 5.12½c., New York, in January, and the low at 4c. in March. The 1920 average price was 8.07c., while that of 1913 was 4.40c. At the end of 1921 the price was 4.70c., New York, where it had remained since late in September. Price liquidation in 1921 was complete and the market placed on a substantial, normal basis. There were prospects of a scarcity of lead in England, with exports from this country a probability in 1922.

A Very Lean Year for Zinc

Two features characterized the zinc market in 1921. One was the import of foreign zinc in the early part of the year and the other the drastic decline in foreign demand as contrasted with war and previous years.

Early in the year 10,000 tons of German zinc was purchased for consumption in this country and there were also re-shipments to this country from England of American zinc sold to British consumers. These imports were a factor only in the early months of the year.

In exports the year 1921 was a sharp contrast to previous ones. To Nov. 1, the latest available data, only 3,733,959 lb. had been exported as against 204,178,991 lb. to Nov. 1, 1920, and 211,518,470 lb. to Nov. 1, 1919. The feature of the 1921 exports was the sales to Japan. Of the total to Nov. 1 Japan bought 2,533,310 lb., or 68 per cent. France and England, the heavy buyers in 1919 and 1920, had bought none up to that time.

Price liquidation was completed in 1921; it had not been finished in 1920. The high for the year for prime Western zinc was 6.10c., New York, in January, with

the low at 4.62½c., New York, at the end of August. At the close of the year the price was 5.15c. to 5.20c., New York. That liquidation has been thorough the citation of previous prices shows convincingly. In 1920 the average New York price was 8.08c. and in 1913 and 1914 it was 5.76c. and 5.27c. respectively. The closing price of 1921 is therefore almost a parity with that of 1914.

Buying of zinc throughout the year was largely of the hand-to-mouth order, excepting a few cases, and the year closed with demand light but with prospects for better business in 1922.

No Serious Labor Troubles

Many Threats But Few Strikes, Except in Building Trades—Cause of Collapse of Railroad Tie-up

TRANSPORTATION and labor troubles as they affected the iron and steel industry in 1920, were largely of the barking-dog variety; they threatened, but usually failed to occur. There was a threat of trouble in the forming by the American Federation of Labor of a new committee for organizing the iron and steel industry, but it proved to be nothing more than a threat. Having learned by the experiences of the disastrous strike of the fall of 1919 that unionization of the plants was possible only by first conquering the Steel Corporation, the plans of the new committee called for a concerted and exclusive drive on the plants of that interest. The Steel Corporation, it was figured, would be the first to cut wages as it had been first to advance them, and the union leaders contemplated using the wage reductions as an argument why the men should organize. The Corporation, however, was the last to cut wages and the union hopes thereby were blasted. There was a country-wide disturbance among the building trades following attempts to revise downward the wage scales of those crafts, and these troubles exerted considerable influence upon the iron and steel industry in that the resumption of building operations following such disputes left wages of this class of labor largely unliquidated, and this phase stopped a good deal of construction which might have gone forward if wages had gone down in keeping with the costs of materials.

Old Transportation Troubles

Transportation troubles entirely were absent last year, in sharp contrast with 1920, when they were a pretty constant source of annoyance, and more so to the iron and steel industry than any other, since fuel and grain took preference over iron and steel in the allocation of freight cars. It was November before the iron and steel makers finally were freed from the exacting and oppressive restrictions as to the use of cars in 1920. This condition grew out of the coal miners' strike late in 1919, the walkout of the railroad yardmen in the spring of 1920, the impairment of the efficiency of railroad employees, brought about by the fact that under such an impersonal "boss" as Uncle Sam there could not be the discipline to be looked for under a Willard, a Hill, a Rea or a Cassatt. On top of these conditions was the post-war business boom of 1920 with its huge demands upon the transportation facilities.

Changed Conditions in 1921

The picture for 1921 is quite a different one. The reaction in business from the feverish activity of 1920 was even more pronounced and rapid than the recovery from the stagnant period in early 1919, following the signing of the armistice, and demands upon the railroads, notably from the iron and steel industry and the coal and ore industries, which provide so much of the bulk freight, declined in keeping with business. There was not a time during the entire 12 months that the railroads could not handle every pound of freight offered and provide service that, as compared with 1920 and, indeed, with several previous years, was vastly superior. Throughout the year there was a surplus of freight cars, which during the height of the business depression in mid-summer reached a total in excess of 500,000.

Threatened Strike

The 12 per cent reduction in railroad wages made by the Railroad Labor Board, effective July 1, did not rest well with the several railroad brotherhoods and unions and a strike ballot was taken, which the brotherhood and union leaders said was overwhelmingly in favor of a strike. Leaders of the steel plant strike of late 1919 also said the vote of the workmen was overwhelmingly in favor of a strike, but they never produced the tally sheets or any other evidence to support such claims, and the public had only their word for it. The same thing is true of the strike vote of the railroad employees last summer. The leaders said they had the authority to call a strike from the men of their organizations and accordingly the strike orders went forth which were destined to completely stop the operation of the railroads of the country between Oct. 31 and Nov. 5.

Numerous and feverish conferences were held in Washington and Chicago, with much noise from both points and from both sides of the controversy, but suddenly just a few days before all business was to be brought to a standstill by the suspension of railroad operations, the strike order was rescinded. There was some disposition at the time to ascribe the calling off of the strike to a vague promise said to have been made by a member of the Railroad Labor Board that further wage reductions would not be considered until after the board had completed its revision of working conditions, and since this was to take considerable time, the men thereby were assured of the July 1 scales for some time to come. This made good newspaper copy, but the real reason the strike was called off was that the union leaders discovered that the strike entirely lacked public sympathy; that the railroad management actually wanted a strike because there were so many thousands of men, who had secured railroad experience during the period of Government control and later let out, who were idle and would have been glad to be taken back and given high places in the seniority lists which those who struck would have sacrificed; and that to have gone through with the strike would have meant te end of the brotherhoods and unions and the undoing of the years of effort in their upbuilding. Self-preservation is the first law of nature and the union leaders wisely decided that it was better to go along with the economic and industrial readjustment than to take a chance on being dashed to pieces on the rocks of an unpopular strike. A strike occurred on some of the Texas roads late in October, but it was neither general nor of long duration. There were suggestions in the fall of a shortage of coal cars, but this turned out to be nothing more than a cutting down of car placements at mines which had been using cars for storage purposes.

Reductions in Steel Plants

Labor troubles within the iron and steel industry were practically unknown despite rather frequent wage reductions which carried the base or common labor rate from 46c. per hr. with time and a half for work in excess of eight hours back to 30c. an hour, with no overtime payments at the plants of the Steel Corporation and of independent companies having works in the same centers as the Corporation, and to as low as 25c. and even 20c. an hour in some centers. Moreover, the iron and steel industry did not average 50 per cent operations for the year and since during the first eight months of the year the average was nearer 30 per cent, recourse to part time schedules and to a distribution of work, in order that all might have a share, was necessary.

The industry was more disturbed from labor troubles from without than within. Chief of these was the trouble among the building trades, growing out of the efforts of employers to put wages on a basis more in keeping with economic and industrial changes following the collapse of the business boom, and price inflation during the latter part of 1920. The stubborn refusal of the building trades unions to either accept a reduction in wages or to modify working rules and conditions which would have increased production without decrease in rates, precipitated strikes in practically all of the large cities of the country during the year.

Building Interrupted

These disputes interfered seriously with building activities not only physically, but because they caused the postponement of many projects by investors, who, despite the decline in the cost of materials, still were confronted by a relatively high total cost because of the demands of labor. If the building trades had been willing to go along in the readjustment, it is safe to say new construction easily would have been double what it actually was during the year. The lack of houses has been a crying need for the past few years and if labor had been reasonable, two houses probably would have gone up where only one actually has been built. The need of new hotels and office buildings has been only slightly less pressing than new housing and that has been only a slight correction of the shortage may be charged, not against the cost of materials, which all, notably steel, have come down materially in price, but because it has been little, if any, cheaper to have a ton of steel set in place or 1000 brick laid.

Boston suffered first from a building trades strike, which came Jan. 19, as a result of a reduction in skilled labor rates from $1 to 90c. per hour and in unskilled labor scales from 65c. to 70c. to 55c. to 60c. per hour, effective Jan. 20. Then followed a period of three months during which employers, and union leaders, were closeted with city and State officials in an effort to bring about a settlement. The conferences failed because of the obstinacy of the union leaders, who would neither accept a wage cut nor modify working conditions to the extent of granting "a fair day's work for a fair day's pay." The upshot of the Boston affair was a declaration by the employers of the "open shop," the application of which brought results where conferences had failed. Other New England cities had similar troubles. Cleveland had a strike starting May 1, which virtually tied up all building work for a period of five weeks. Pittsburgh had a strike which was fairly effective for a time but which faded out and finally was settled in early fall by the acceptance by the men of reduced scales. Chicago had a siege beginning in May, which was not fully adjusted at the end of the year. If there is a big city in the country which escaped a building trades dispute, the fact is pretty well concealed.

The effect of the building trades disputes upon the demand for steel may be gaged by the reports of the Bridge Builders and Structural Society, which for the 11 months ended Nov. 30, show that the average of fabricated structural steel orders was only 34.6 per cent of the total shop capacity of the country and this despite a drop of 40 per cent in the cost of plain material, which was fully reflected in fabricated material prices. The average price of plates, bars and shapes, which as of Jan 1 was 2.50c. was down to 1.50c. at the end of the year.

Reduced Earnings of Many Companies

Past Year Makes a Decidedly Unfavorable Showing Compared with Prosperity of 1920

From the viewpoint of earnings, 1921 will go down in the history of the steel industry as a decidedly unprofitable year. But, in this respect, the plight of the steel companies is somewhat magnified in the reflection of a series of preceding prosperous years. Even earnings for 1919, a year of serious labor disturbances, now appear favorable in the light of those for the past twelve months.

During the preceding prosperous years, the older steel companies materially added to their surplus accounts, as well as to physical properties. The younger corporations, as well as those starting business in the war years, absorbed a large share of current earnings in plant development. Naturally the last two classes of industry have suffered more keenly than the first.

Small and relatively unimportant steel companies, unable to stand up under rapidly dwindling cash and marketable resources, have been forced into bankruptcy or the management of their affairs dominated by banking interests for the purpose of protecting funds invested in these properties. And yet 1921 was comparatively free from increases in share capitalization and bonded indebtedness. The Bethlehem Steel Co. actually anticipated $7,500,000 7 per cent notes due in July next. The Lackawanna Steel Co. has materially lessened its liabilities, and the final 1921 balance sheets of other large properties should disclose sound fundamental conditions, notwithstanding decreased earnings records for the year.

According to those quarterly earnings statements issued by the independent steel companies, most of them fared worse than the United States Steel Corporation because of its varied earnings power. The Lackawanna Steel Co. for the first nine months showed a deficit after taxes and ordinary charges amounting to $1,208,275, after having stopped dividends, whereas for the same period in 1920 there was a $4,714,370 profit with dividends. The Republic Iron & Steel Co., because of limited operations, ran into large deficits early in 1921, and will make an unsatisfactory annual statement of earnings. The Midvale Steel & Ordnance Co. experienced one quarterly deficit after allowing for taxes, and its 1921 earnings report will also compare unfavorably with that for 1920. Penn Seaboard Steel's consolidated income account for the first nine months showed larger expenses than gross sales, with a resulting net loss of $152,365. After allowing for interest charges, its sinking fund, an adjustment of inventory and other items, there was a deficit of $571,817. And so it goes down the line.

A study of industries over a period of years shows that, after a time when earnings shrink, as a result of a pronounced business depression, a linking up of properties follows in the interest of reduced operating costs. There is no reason to anticipate 1922 will prove an exception. In fact, consolidations of steel, copper and oil properties already are known to be under consideration by banking interests. As regards steel mergers, definite developments will probably be recorded early in the new year. Naturally following 1921 will be a period of years of competition for business and for the refinement of products, when capitalizations, book and liquid assets must combine to yield even a moderate return upon the money invested.

Engineering Standards Discussed at Cleveland

A reception for Dean Dexter S. Kimball, Cornell University, the new president of the American Society of Mechanical Engineers, was given by the Cleveland section of the society Dec. 29. Following a dinner Dean Kimball led in an open discussion on the subject of the general welfare of the engineer. E. C. Peck, Cleveland, chairman of the national committee of standards, spoke on the desirability of establishing standards and outlined the work that has already been done by his committee. He said that 15 standards have already been established and 75 others are being started by the committee.

The Year in Iron and Steel Metallurgy

Developments in Electric Steel—New Features in Open-Hearth Practice—Alloy Iron and Steel—New Theory of Hardness

BY JOHN HOWE HALL*

DURING 1921 continued progress has been made in the development of the concentrating and sintering plant of the Mesabi Iron Co., which is developing a large tract of low-grade iron ore in the Eastern Mesabi district of Minnesota. A very large tract of land containing the ore body is being developed. The ore is a magnetic taconite and is crushed, concentrated on magnetic concentrators and sintered. The first unit of the sintering plant, with a capacity of 1000 tons of sinter per day, is nearly complete, making the first step in a development which contemplates ultimately a production of 30,000 tons of sintered products every 24 hr. It is expected also that eventually a low phosphorus ore may be produced. The product of the plant is already on the market in quantity.

Experiments have been carried out in Canada on the blast furnace smelting of titaniferous iron ores on an entirely different principle from that followed in all previous trials. Heretofore the titanic oxide has been considered as an acid in the slag, and limestone has been used as a flux. In the experiments recently conducted, advantage was taken of the fact that titanic oxide is chemically amphoteric, i.e. it will act either as an acid or as a base, depending upon which is in excess in the slag. Silica was used as a flux instead of limestone and the slags are said to have been entirely satisfactory and the results of the trial most encouraging. Should further work demonstrate the feasibility of this method, a large field will be opened up in the use of titaniferous iron ores, including those which carry a considerable percentage of silica.

Electrolytic Iron Tubes

Experiments are being made on a considerable scale in the production of iron tubes by electrolytic deposition on a rotating mandrel using an insoluble anode. This process has already been developed in France using hot ferrous chloride solution as an electrolyte. It has been found recently in the work done in this country that the solution can be made to greater advantage from iron ore. The metal of the tubes produced runs from 99.97 to 99.99 per cent iron. The tubes when removed from the mandrels are annealed to eliminate the brittleness characteristic of electrolytic iron as deposited. The French metallurgists who have developed the process claim that they are already in a position to compete with other processes for thin tubing.

Blast Furnace and Cupola Iron for Castings

In the new Ford foundry, which is to have a final capacity of 2500 tons of castings per day, four cupolas are now in operation of the 24 which will eventually constitute the complete plant. This is probably the first foundry to undertake the use of direct metal from the blast furnace on a large scale. The iron produced by the blast furnace has run very uniform in analysis, and castings have already been produced on a commercial basis with as high as 80 per cent direct blast furnace iron and 20 per cent cupola metal. This very high percentage of direct iron will probably not be used except in rare cases and probably a 50-50 ratio will be the average. So far most of the castings made have been poured from a mixture varying between 40 per cent direct to 60 per cent cupola metal, and 60 per cent direct to 40 per cent cupola metal.

The cupolas are mechanically charged by means of cars which dump the stock into chutes of which there are two for each cupola, so that the iron can be charged from both sides. The hot metal from the blast furnaces is brought to the foundry in 75-ton ladle cars, whence it is poured into 20-ton mixer ladles, where it is incorporated with the cupola iron. From the mixer ladles it is poured into regular foundry ladles for distributing to the pouring floors.

High and Low Voltage for Electric Furnaces

A report by the Electric Furnace Association calls attention to the consensus of opinion as to the relative advantages of high and low voltage in electric furnace work. Apparently it is felt that voltages up to 140 are satisfactory, but there seems to be a feeling that voltages of 160 to 250 are not desirable, as the long arc produced by such current is hard on the brick work of the furnace and is supposed to have a deleterious effect on the metal. While it is believed that the harmful effect on the steel can be corrected by lengthening the final refining period, yet most operators consider it better policy to use a lower voltage, which has no bad effect on the metal at any time, rather than first doing harm to the steel for the sake of saving time in melting, and afterward trying to undo this harm in the refining period. It will be interesting to see how far these conclusions are borne out in future practice.

Government Electric Steel Plant

The outstanding achievement of the year in electric furnace practice has been the successful starting up of the two 40-ton Heroult electric furnaces in the Government Armor Plate plant, Charleston, W. Va. These furnaces, which are of the usual circular cross-section, have a shell 18 ft. in diameter and 8 ft. high, are lined 18 in. thick in the side walls and provided with three electrodes, 24 in. in diameter in the case of amorphous carbon and 14 in. in diameter for graphite. The furnaces are, of course, arranged to tilt up for pouring in the usual manner.

Two 75-ton basic open-hearth furnaces are used in the plant to provide hot metal for the electric furnaces. In the open-hearth furnaces the phosphorus is reduced to about 0.015 per cent and the finished steel from the electric furnaces runs a little over this figure on account of slight rephosphorizing from the small amount of open-hearth slag which gets into the furnaces with the metal. The sulphur of the steel so far produced has varied from 0.008 to 0.015 per cent and, of course, the metal has been very thoroughly deoxidized and of the highest quality.

The plant is thus equipped to pour ingots of electric furnace steel up to 80 tons weight and open-hearth ingots up to 150 tons. By mixing the two kinds of metal, of course, even larger masses could be cast.

The successful operation of a plant producing steel of the very highest grade on such a large scale is a land-mark in the already rapid development of electric furnaces, and the designing skill shown in building these large units is worthy of the highest praise. We

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are informed that even larger furnaces are contemplated and that the 100-ton electric furnace will be here much sooner than could possibly have been anticipated a few years ago.

New Induction Furnace

Somewhat to the surprise of electric furnace operators in this country, an attempt is again being made to develop the induction furnace on a commercial scale. In the type being tried out, the primary winding is placed above the crucible in order to remove it from danger of a break-out, instead of placing it on a level with the metal as in most previous designs. As the furnace necessarily operates on low frequency power, a motor generator set is needed to convert the available power to single phase current of low frequency. From the point of view of cost, of course, the expense of this motor generator set has to be compared with that of the transformers of an arc type furnace. A 2-ton unit has been built and is in regular operation for foundry work. In view of the difficulties which have been experienced in the past, especially the practical impossibility of building the lining of the crucible so that it would "stay put," the results of this new experiment will be watched with great interest.

During the year one of the largest producers of manganese steel castings in this country has turned to the use of the electric furnace for the manufacture of manganese steel. Although other makers of this alloy steel are already using the electric furnace, this is the first case, to the author's knowledge, where the electric furnace is contemplated for all or a very large part of the output of one of the leaders in the industry.

Improving Open-Hearth Ports

For a good many years efforts to increase the life of the ports of open-hearth furnaces have been directed chiefly toward the protection of the brick work by water cooling without radical change in the construction of the furnace. The problem has also been attacked in another way by providing spare ports already built up in a movable frame so that replacement could be made in the shortest possible time. Although these methods have, to some extent, expedited repairs and increased the life of ports, yet neither line of attack has been wholly satisfactory.

Recently several very radical changes in the design of open-hearth furnaces have been made with the object not only of increasing the life of the ports but of improving the efficiency of combustion of the fuel and hence the output of the furnace. In a general way the objects aimed at in these different designs are somewhat similar and are based on the idea of securing complete combustion of the fuel in the first few feet of the hearth, and of slowing down the outgoing gases in order to prevent them from coming in contact with the outgoing port at such high speed as to rapidly melt it away.

The Egler Furnace

In what is known as the Egler type a blow torch effect is given to the flame by mixing the air and gas in the port instead of in the hearth. In burning producer gas the object in view is attained by putting positive pressure on both air and gas and bringing the latter to the furnace by means of an up-take flue located in the position usually occupied by the air flue. This vertical up-take is connected with the hearth by a flue or port in the usual manner, but the air instead of being introduced through a separate opening above the gas is brought vertically into the bottom of the gas port through a suitable up-take.

At each end of the furnace are two auxiliary flues which can be closed by water-cooled mushroom valves. These flues are kept closed at the incoming end of the furnace, and those at the outgoing end are kept open. The area of the passages carrying away the products of combustion is thus greatly increased so that the speed of the outgoing gases is considerably reduced. It has been found that the port temperature is not unduly high, that the roof can be kept cool by admitting a small surplus of air over that needed for combustion, and that a very high hearth temperature and very perfect transmission of the heat to the bath are secured. The time per heat has been greatly reduced and the output of the furnace correspondingly increased. For coke-oven gas and natural gas only one set of regenerators is used, and the gas is admitted to the air port by pipes located one on each side. For oil or tar the fuel is brought in by means of a burner in the end wall.

The McKune Furnace

The McKune design was first tried with by-product coke-oven gas. At each end of the furnace are three up-takes of which the central one is used as a port and the two outside ones at the incoming end are closed by dampers, while the corresponding ones at the outgoing end are open. The air is introduced under a fan pressure of about 6 oz., and the gas is introduced through pipes at each side of the central port. The fuel is burned very completely in the first 10 ft. of the hearth and the results secured in decreased time per heat and increased production have been very satisfactory.

What is called the Venturi line furnace works more or less on the McKune principle and was first developed for producer gas. In this type the port area is decreased by lowering the roof knuckles of the furnace, and moving in the wing walls in such a way as to form knuckles in the side walls, thus restricting the opening in two planes. In addition the mouth of the gas port proper is moved about 3 ft. back from the point of greatest restriction, thereby providing a channel where air and gas may mix before entering the hearth. No pressure is used on either air or gas but, as the furnace is fitted with waste heat boiler, induced fan draft is used.

McKune and Venturi Furnaces

A combination of the McKune and Venturi line type is also being worked out in which water-cooled dampers which are lowered one on either side of the gas port take the place of the knuckles in the side walls of the original Venturi design. These dampers, of course, are lowered at the incoming and raised at the outgoing end. In the first furnace of this type the neck opening is 13 sq. ft. at the incoming end and 31 sq. ft. at the outgoing end. The air is introduced under fan pressure and, as the furnace is provided with waste heat boilers, induced draft is used.

Coke-Oven Gas for the Open-Hearth

In the burning of by-product coke-oven gas trouble has always been encountered because of the tendency of the flame to rise from the bath and to burn without luminous effect. Tar has often been blown into the furnace over the gas in order to give a luminous flame. At one of the large plants it has been discovered that by admitting a small amount of air in the burner a luminous flame can be obtained, and that by varying the amount of this air the flame may be varied at will from non-luminous to very bright. In this plant short shut-downs of the furnaces have been necessary in the past in order to clean the underground flues which bring the producer gas to the furnaces. Arrangements have now been made to bring by-product coke-oven gas to each furnace and, while the producer gas flues are being cleaned, the furnaces are successfully operated on by-product coke-oven gas. Several long runs have been made with the latter fuel alone and one furnace made a run of 55 straight heats with by-product gas.

Benjamin Talbot has taken out patents covering the

design of tilting open-hearth furnaces of much larger capacity than any now built for use in his continuous process. In these furnaces a longitudinal wall divides the hearth of the furnace into two chambers and serves to support the very wide roof made necessary by the large size of the furnace. Passages are provided connecting the two baths and the furnace is arranged to tilt endwise instead of sidewise as in the old design.

Cupolas and Open-Hearths for Duplexing

During the year a very interesting description was published of a large scale experiment in the use of cupolas to provide hot metal for open-hearth furnaces. In the particular plant where this trial was made the four 60-ton basic open-hearth furnaces were fed with hot metal from a single blast furnace, but there was no mixer. During repairs to the blast furnace the furnaces were being run on cold charges of pig iron of which about 20,000 tons was on hand in one large heap, the silicon in the pig varying all the way from 0.50 to 6.00 per cent. Considerable trouble was encountered when a charge consisted largely of high silicon iron, as the bath of course then melted high in silicon with resulting delay in the operation.

Two large spiegel furnaces, each 6 ft. in diameter inside the lining, and 30 ft. high from the bottom to charging door, were used to melt the pig iron for the furnaces. It was found that by varying the amount of limestone charged in the cupola, the amount of silicon oxidized and slagged could be increased or decreased and in this way a good deal was done in reducing the silicon when it was found that a large proportion of the higher silicon iron was being charged. It was thought, when the experiment was started, that the cupolas would not be able to take care of the four open-hearth furnaces, but it was found that keeping them in blast only 18 hr. out of a possible 24 hr., they melted enough iron to furnish each of the open-hearth furnaces with 50 tons of hot metal at regular intervals. During the run about 13,000 tons of iron was melted, and the production of the open-hearth furnaces was increased very considerably over what was possible with cold charges. In fact, in one month the open-hearths produced more steel than they ever had when taking iron from the blast furnace, owing largely to the elimination of delays in waiting for blast furnace metal.

Although, of course, difficulties would necessarily be encountered in operating cupolas continuously and keeping them "in step" with the steel making equipment, yet the author of this article feels that in some instances at least cupola melting of the charges for the open-hearth furnace would be a paying proposition in plants having one or more open-hearth furnaces but no blast furnace to supply hot metal.

A German investigator published an article during the year on the influence of the time at which silicon is added to the ladle in the manufacture of basic open-hearth steel. He concludes that if the silicon is thrown in the bottom of the ladle before the heat is tapped, a greater loss of silicon and more blow holes in the ingots are encountered than is the case if the silicon is thrown in the ladle quite late in the tapping of the heat.

Oil as a Fuel for Cupolas

In Germany a trial was made of the use of oil to replace part of the coke in cupola melting. The oil flame was introduced through the tuyeres and blown against the incandescent bed of coke and the results are said to have been satisfactory and the saving in fuel considerable. From a published description of the experiment, the method appears to have been quite similar to that developed and patented in this country by Bradley Stoughton.

While nothing strikingly new has come up in the use of electric heating for heat-treatment furnaces, yet continued progress has been made in the design of these furnaces and the number of installations is increasing quite rapidly. In most cases the cost of the electric heating is greater than that of mineral fuel, but this increased cost is offset to a considerable extent by the decrease in repair charges; the freedom from scaling due to the inert atmosphere of the furnace, coupled with the much better control of temperature, makes electric heating highly desirable for an increasing number of applications.

Better Malleable Castings

The Malleable Iron Association has published a report showing the progress made by its members in improving the quality of their product, especially during the last 3½ yr. In that period the average tensile strength of the test bars submitted by the members increased from a little under 49,000 lb. per sq. in. to over 53,000 lb., and the elongation from under 10 per cent in 2 in. to nearly 16 per cent. In June, 1921, the average extension was 15.77 per cent, or over twice that specified by the American Society for Testing Materials. In April, 1921, the average tensile strength of the test bars submitted by members was 53,530 lb., which is more than 8000 lb. over the minimum A. S. T. M. specification. The association feels that it has made great progress in the improvement of the average output of its members, and that the results shown in these test bars are a fair measure of the improved quality of their product.

Centrifugal Steel Castings

Results have been published showing the possibilities of castings both of carbon and of nickel steel made by the centrifugal process. The castings in question were cylinders with walls varying from 0.50 in. to 3.50 in. thick, and the only segregation found in the castings was in a radial direction. By heat treatment of the steel physical properties were secured which suggested the possibility of producing steel by this method with physical properties as good as those of forgings.

New Way to Make Welded Pipe

An interesting new development in the manufacture of welded pipe is a new plant designed to produce hammer welded steel pipe from 24 in. to 96 in. in diameter and with walls from ¼ in. to 1½ in. thick. Open-hearth steel plate is bent either hot or cold, depending on the thickness, by means of rolls such as are used in boiler shops. The lap is then heated with gas burners both inside and outside for a short distance and welded by means of a power hammer working against a suitable anvil within the pipe. Another section is then heated and welded, and so on until the weld is completed. This makes available larger sizes of welded pipe than have heretofore been on the market, which is of considerable advantage as compared to riveted pipes. On account of the friction in the latter a welded pipe of a given size will carry more water than the same size of riveted pipe, or to carry a given quantity of water a smaller-sized pipe may be used.

Stainless Iron

In the field of alloy steels progress has been made in the development of stainless iron, which is an alloy similar in composition to stainless steel, except that the carbon is below 0.10 per cent. This is an electric furnace product and has certain advantages over stainless steel in that it can be used for a wider range of forging, pressing and stamping operations. Already it has been developed on a commercial scale for the manufacture of automobile wheel disks, hoods, bodies, etc.; carbon-free ferrochrome is used in the manufacture of this metal.

Alloy-Iron Castings

Experiments have been made in Germany on the

addition of nickel and cobalt to cast iron. The latter was found to reduce the strength and to increase the hardness and hence to hold forth little promise of usefulness. The nickel in quantities up to 1 per cent raised the bending strength 30 per cent, the compressive strength 30 per cent, and the tensile strength 18 per cent. A large motor corporation in this country is reported to be using 1 to 1.50 per cent nickel in cupola castings and to find the iron harder and to possess better resistance to wear. Small amounts of nickel and chrome are also being tried as additions to car wheel mixtures.

One firm manufacturing electric resistance grids, which are castings of very small section and which must be of gray iron, are melting the metal for these castings in the electric furnace and using from 4 to 5 per cent nickel in the iron. In addition to its effect in increasing the electric resistance, the nickel is said to assist in the formation of graphite as the iron cools, and hence to make very light sections gray and soft.

Molybdenum Alloy Steels

Further data have been published on the influence of molybdenum in small percentages (up to 1 per cent) in nickel, nickel-chrome, chrome and chrome-vanadium steel. The figures which have been published show an increase in strength due to the molybdenum with a simultaneous increase in ductility, especially in the reduction of area. In this same connection tests have been published on cast steel containing 0.27 per cent carbon, 1 per cent chrome, and 0.50 per cent molybdenum, heat-treated by quenching and drawing. The castings showed properties closely similar to those of forgings with a tensile strength of about 99,000 lb. per sq. in., an elastic limit between 65,000 and 66,000 lb. per sq. in., an extension of about 21 per cent, and a reduction in area of over 50 per cent.

Sulphur in Steel

The investigation into the influence of sulphur and phosphorus on steel which is being carried out by a representative committee from various scientific bodies under the chairmanship of the Bureau of Standards has made considerable progress during the year. The tests on the first class of steel selected for work are completed and the results will soon be published in the form of a Bureau of Standards bulletin. The manufacture of the next class of steel in order is under way.

In this connection it is interesting to note that the American Society for Testing Materials has voted to remove the temporary note allowing increases in phosphorus and sulphur on 14 of their standard specifications. The only exception to this action was to continue in force the increase of phosphorus and sulphur by 0.01 per cent in the case of steel castings and the increase of sulphur by the same amount in the specifications for structural steel for locomotives, cars and ships.

During the year a notable book on the heat treatment of medium carbon steel by a distinguished Italian metallurgist has been published in this country. The most noteworthy feature of this book from the practical man's point of view is the remarkably good results secured by careful heat treatment of nickel steel castings. Indeed, the author ventures the opinion that in some cases a casting may be superior to a forging because the casting is not subject to the transverse weakness often characteristic of a forged piece and most difficult to correct by heat treatment.

New Theory of Hardness

In the field of purely theoretical work the most striking contribution of the year is that of Zay Jeffries, who has put forward a new theory to account for the hardening of metals, known as the slip interference theory. In brief, Dr. Jeffries reasons that every known method of hardening metals can be referred to the principle of slip interference. Mechanical failure under stress is ordinarily premature because of the presence of crystallographic planes of weakness or potential slip planes, and any structural condition which interferes with slip on these planes of weakness increases the strength and hardness of the metal. Conditions which bring this about may be grain refinement, presence of amorphous metal, presence of a strong constituent at the grain boundary, or the presence of hard constituents within the grains themselves uniformly distributed in the form of very fine particles. This new theory has brought out a great deal of discussion.

Buying of Railroads at Low Ebb in 1921

Car Repair Orders Far Exceed Purchases of New Cars, the Latter Being the Smallest Since 1900—Rail Buying at Lowest Point in Years

IN a year of pronounced dullness in the iron and steel market, railroad purchases were conspicuous only because the individual tonnages placed were large in comparison with orders coming from other sources. In the aggregate, however, railroad buying was extraordinarily light and proved a disappointment to those who expected the accumulated deferred needs of several years to force large scale purchases. Just as their hopes were stimulated in March, 1920, when the railroads were released from Government operation and in August, 1920, when they were granted substantial rate increases, their expectations rose periodically during the course of the past year, as, for example, in February with the passage of the Winslow-Townsend bill authorizing the payment of $350,000,000 due the railroads from the Government, and again on July 1, when railroad wages were reduced 12 per cent.

Optimism Not Justified

The failure of any of these flashes of optimism to find justification in subsequent events is now a matter of history. As early as January, railroads grew more conservative in their expenditures concurrently with a sharp decline in their freight loadings. This attitude was accentuated as their business continued to diminish and their costs mounted higher than their returns. By the end of the first quarter, the situation became so acute that the railroads had closed many of their shops and laid off thousands of men in an effort to reduce their costs. Repair work was postponed indefinitely, with the result that the number of bad order cars increased markedly. By the middle of May, buying had dropped to a low ebb, purchases being confined to small miscellaneous supplies for shop storekeepers' stocks. At that time, railroad stocks of all classes of material, steel included, were not more than one-half what they had been at the beginning of the year. Not only were the railroads unable to make new purchases, but they were also unwilling to receive shipments against previous orders. Releases against rail contracts dropped off sharply, with the consequence that rail mill operations were adversely affected. On May 19, it was recorded in our columns that five of the strongest Western lines had not laid a rail since the first of the year, despite the fact that some of their 1921 rails had been delivered. One of these roads, in fact, had received 60,000 tons which it had put in storage.

General Desire to Postpone

One reason for the inactivity of the railroads during

this period was a desire to postpone all work possible until railroad wages were reduced. And it is a fact that most of the railroad purchases of the year followed the wage cut of July 1. This buying, however, is probably attributable more largely to the fact that freight traffic revived in the last half of the year and net profits replaced the deficits suffered by the carriers in the early months of 1921. In the buying which did ensue, primary attention was given to car repairs. Of 41,040 cars let for repairs, as reported in our columns, contracts for all but 7000 were awarded in the last five months of the year. Besides the repairs let to private shops, there was some work done by the railroads' own forces, of which we have no record. In comparison with orders for repairs, purchases of new cars were insignificant. According to our records, orders for freight cars by domestic purchasers total 18,040 for the year, of which 12,440 were placed in the last quarter. It seems probable, therefore, that when complete figures are available for the entire year, the total for 1921 will be below that of 1919, 25,899 freight cars for domestic service which was the lowest since 1900. The full significance of the year's orders is grasped when it is realized that the total is hardly more than 10 per cent of the average annual purchases for the 13 years, 1901 to 1913 inclusive, which amounted to 180,000 cars. The 1921 total is also small compared with the average of annual orders during the period of light buying from 1914 to 1920 inclusive, which was 96,000 cars.

Passenger Equipment

Purchases of locomotive and passenger equipment were equally light. Orders for passenger cars in 1921, as recorded in our columns, totalled only 240, less than were ordered in any year since 1900, except in 1918 when 131 were bought. Orders for locomotives, as reported in our issues throughout the year, totalled only 255, the smallest number ordered in any year since 1900, and comparable with the small total of 1919, which was 272. The lack of buying during the past year is appreciated when one compares the number of locomotives bought with the average of purchases from 1901 to 1913 inclusive, which was 3800, and with the purchases during the period of curtailed buying from 1914 to 1920 inclusive, when the average was 1938.

The restricted buying during 1921 was accompanied by sharp declines not only in the prices of railroad rolling stock, but also of steel. During 1920, prices of cars and locomotives reached their peak. Mikado-type engines of 330,000 lb. weight brought as high as $70,000 each, whereas 50-ton steel box cars cost as high as $3,600. During the past year, prices of freight cars have been reduced 30 to 35 per cent and locomotives 25 to 50 per cent. On the other hand, the sharp reduction in steel is appreciated when it is recalled that the peak price for tank plates in 1920 was 3.75c., f.o.b. Pittsburgh, as against 1.50c. at the present time, a reduction of 60 per cent. Going back only so far as Jan. 1, 1921, when the market on tank plates was 2.65c., f.o.b. Pittsburgh, the reduction amounts to 43 per cent. The decline in steel becomes even more impressive in view of the fact that the Pittsburgh basing on tank plates as well as on structural shapes and bars, was openly abandoned in the Chicago market in August and from that time on car builders obtained prices f.o.b. Chicago, which were practically on a parity with prices quoted in the Pittsburgh district.

Rail Buying Very Light

Rail buying was extraordinarily light in 1921. Although complete statistics are not available, our records show orders for only 399,000 tons of which all but 51,400 tons are for 1922 delivery. At this time a year ago, most of the tonnage for 1921 rolling had already been placed, but this year the carriers are unusually tardy in making reservations for their requirements, the only orders of any size which have been placed, being those of the New York Central, Southern Pacific and Norfolk & Western for 125,000, 44,600, and 40,000 tons respectively. The tonnage thus far placed for the coming year is exceedingly small as compared with the annual consumption of rails in this country as disclosed by statistics compiled by the American Iron and Steel Institute. During the 13 year period before the war, rail consumption ranged from a minimum of 1,726,224 tons in 1908 to a maximum of 3,654,794 tons in 1906, and during the years 1914 to 1920 inclusive, ranged from a minimum of 1,568,408 tons in 1919 to a maximum of 2,440,755 tons in 1917. Rail mill operations were exceedingly irregular during the course of the year. In the early months, heavy production was the rule. In March the Gary mill made a world's record of 92,600 tons rolled and shipped and in April nearly equalled that figure with 88,000 tons. In May, however, the railroads commenced to suspend shipments against their contracts and it was not until the latter part of the year, when rails were reduced to $40 a ton, that the railroads again authorized deliveries in any quantity.

Track Supplies Dull

Orders for track supplies were light during the year and most of the business placed was concentrated in the last six months. Prices of these materials declined sharply during the 12 months: track bolts from 4.60c., Pittsburgh, to 3.20c.; standard railroad spikes from 3.65c., Pittsburgh, to 2.15c.; and tie plates from 3c., f.o.b. mill, to 1.90c.

Railroad bridge and building construction was of small proportions in 1921. Among the few projects which were undertaken was the mail terminal building and the Canal and Van Buren street viaducts of the Chicago Union Station, the steel for which amounting to 8160 tons was let the latter part of March. Another important job which went ahead was a large machine shop erected by the Atchison, Topeka & Santa Fe at Albuquerque, N. M.

Railroad buying of machine tools was on an unusually limited scale in 1921. The only order of any size placed during the first half of the year was that of the Santa Fe for $125,000 worth of equipment for its Albuquerque, N. M., shop. In October the same road placed orders for one 250-ton, one 5-ton and six 15-ton cranes for the same shop. In June the Great Northern closed for $25,000 worth of equipment. In July the Illinois Central bought $150,000 worth of machine tools and this was the only purchase of importance until the last quarter when the Toledo & Ohio Central bought $50,000 worth of tools, the Virginian $20,000 worth, and the Missouri, Kansas & Texas closed for a list of 86 machines. Other lines which bought in a limited way during the last quarter were the Erie, the Cleveland, Cincinnati, Chicago & St. Louis (Big Four), the Boston & Albany, the Union Railroad and the Santa Fe.

Inquiries Pending

As the new year opens, several large inquiries for cars are pending and a number of extensive lists of machine tools are being figured on and others are being prepared. The year 1921 was exceedingly unsatisfactory from the standpoint of car and locomotive builders and machine tool manufacturers and all are glad that the year is now behind them. The same may be said of those makers of iron bars, bolts and nuts, springs and malleable castings whose chief business is with the railroads, as they too experienced a very discouraging year from the point of view of both orders and profits. In looking ahead into the coming year, better business is expected, although the railroads themselves are regarded as the chief remaining obstacle to a return to normal industrial activity. Substantial reductions in freight rates and if necessary to that end, further cuts in the wages of railroad employees are generally considered essential to complete the economic readustment which has been going on during the past 12 months.

The Ohio Structural Steel Co. has established a plant at Newton Falls, Ohio, where it is equipped to handle structural and fabricated steel work of a not too complicated nature. M. H. Stauffer, formerly of the Niles Forge & Mfg. Co., Niles, Ohio, is president and general manager. J. S. Mitchell, formerly with the Kansas City Structural Steel Co., Kansas City, Mo., is the company's chief engineer.

The Status of the Electric Steel Industry

United States Still Leads with 388 Furnaces, A Net Gain of About 9 Per Cent in 1921—Furnaces in the World's Steel Industry Probably 1000

BY EDWIN F. CONE

DESPITE the acute depression prevailing in the steel industry last year, the expansion in the electric steel industry in 1921, as measured by the number of new installations of various types of furnaces, was practically equal to that in 1920. This is an unexpected development. No attempt has been made in this year's review to obtain data regarding other countries than the United States and Canada.

On Jan. 1, 1921, according to THE IRON AGE'S annual review of the electric steel industry, published in the issue of Jan. 6, 1921, the United States was credited with 356 furnaces of all types, with 43 in Canada; on Jan. 1, 1922, these totals have been increased to 388 in this country and 50 in Canada. This compares with only 19 such furnaces in the United States and 3 in Canada on July 1, 1913, or nine and one-half years ago. The total in the world on Jan. 1, 1921, was estimated at 961. From facts known and deductions that are possible, the estimated number of all types in the world as of Jan. 1, 1922, is easily 1000 and probably more.

A review of this industry was inaugurated by THE IRON AGE when the first data were published in the issue of July 1, 1913. The German paper, *Stahl und Eisen*, made the first estimate of this nature, which THE IRON AGE amplified for its issue of April 14, 1910. That review showed 114 furnaces of all types in all countries; 29 of them were Heroult furnaces. In 21 years, therefore, the world's electric steel industry has expanded close to 10 fold.

The review which follows gives as complete data as was obtainable regarding every type of furnace. Concerning one prominent type no data were reported by the seller and, as indicated in the tables, one or two other selling companies could not see their way to supply information this year. In such cases, where reliable data could not be obtained from other sources, this information as of Jan. 1, 1921, was left standing. It is acknowledged that this results in incomplete data for the whole industry, but the general trend is indicated, despite the facts that some furnaces may be entirely out of commission.

Progress in the United States and Canada

THE net increase in the number of electric furnaces in the United States in 1921 has been 32 against 33 in 1920; 36 in 1919; 54 in 1918; 97 in 1917 and 63 in 1916. The total on Jan. 1, 1922, was 388 as compared with 356 on Jan. 1, 1921; with 323 on Jan. 1, 1920; with 287 on Jan. 1, 1919; with 233 on Jan. 1, 1918, and 136 on Jan. 1, 1917. The apparent net increase of 32 furnaces in 1921 is less than the actual, due either to the passing out of commission of some installations or to cancellations of contracts, some of which were not reported.

The expansion of the American electric furnace industry may be appreciated when it is recalled that on July 1, 1913, there were only 19 furnaces using electricity. The expansion is therefore over 20 times.

Table of Greaves-Etchells Electric Steel Furnaces Installed or Contracted for in the United States on Jan. 1, 1922, as Sold by the Electric Furnace Construction Co., Philadelphia

Company and Location	Size, Tons	No. of Furnaces	Product
U. S. Navy Yards at:			
Norfolk, Va.	6		Castings
Puget Sound, Wash.	6		Castings
Mare Island, Cal.	6		Castings
Charleston, S. C.	3		Castings
Philadelphia, Pa.	3		
Total		5	Castings
American Radiator Co., Buffalo, N. Y.	6	2	Castings
American Radiator Co., Buffalo, N. Y.	½	1	Castings
Halcomb Steel Co., Syracuse, N. Y.	3	2	Tool steel
Ford Motor Co., Detroit, Mich.	½	1	Castings
Ford Motor Co., Detroit, Mich.	3	1	Castings
Ford Motor Co., Detroit, Mich.	10	2	Steel
Ford Motor Co., Detroit, Mich.	50	1	Steel
Davidson Tool Mfg. Co., New York City	½	1	High speed steel
Hoskins Mfg. Co., Detroit, Mich.	½	1	Nichrome
Sullivan Machinery Co., Claremont, N. H.	1	1	Castings
Dodge Steel Castings Co., Philadelphia	3	1	Castings
Hammond Steel Co., Syracuse, N. Y.	3	1	Castings
Bird-Archer Co., New York		1	High speed steel
Brennan Steel Castings Co., Cleveland, O.	¾	1	Castings
Electric Steel Products Co., Turners Falls, Mass.	1	1	Castings
C. H. Wills & Co., Port Huron, Mich.	1	1	Refining iron
Wayne Steel & Iron Co., Pittsburgh	1	1	Castings
Wayne Steel & Iron Co., Pittsburgh	900 kva	1	Special
Vancouver Engineering Works, Vancouver, B. C.	1	1	Castings
Joliette Castings & Forgings, Ltd., Joliette, Que.	1	1	Castings

Total in the United States, 26; Canada, 2.

There have also been sold a ½-ton furnace to the Imperial Japanese Mint, Osaka, Japan; a 1-ton furnace to Brasilian Military Commission, and a furnace to the Sociedad Espanola de Construccion Naval, Madrid, Spain, for making ferroalloy.

The Ford Motor Co., Highland Park, Mich., recently purchased 4 electric brass-melting furnaces from the Electric Furnace Construction Co.

Table of Volta Electric Steel Furnaces, Installed or Contracted for in the United States and Canada, Jan. 1 1922 as Sold by the Volta Mfg. Co., Ltd., Welland, Ont., Canada

Company and Location	Size, Tons	No. of Furnaces	Product
United States:			
Union Electric Steel Co., Carnegie, Pa.	6	2	Steel
Canada:			
Hydro-Electric Commission, Chatham, Ont.	½	1	Steel or Gray Iron
Hiram Walker & Sons Metal Product Co., Walkerville, Ont.	1	1	Steel
Canadian Steel Foundries, Ltd., Montreal, Ont.	3	1	Steel
Dominion Foundries & Steel, Ltd., Hamilton, Que.	6	2	Steel
Electric Iron, Ltd., Lakefield, Ont.	6	1	Steel
Electro Foundries, Ltd., Orillia, Ont.	6	1	Pig Iron
Shawinigan Foundries, Ltd., Shawinigan Falls, Que.	5	1	Steel or Gray Iron
Turnbull Electro Metals, Ltd., St. Catherines, Ont.	6	1	Pig Iron
Port Moody Steel Works, Ltd., Port Moody, B. C.	6	1	Pig Iron
Lowox Steel Co., Ltd., Vancouver, B. C.	6	1	Pig Iron

Total in Canada, 11; in United States, 2.

The FitsGerald Laboratories, Inc., Niagara Falls, N. Y., has a 1-ton Volta furnace for making brass.

The T. Waddell & Sons Co., Ltd., Christchurch, New Zealand, has a 6-ton Volta furnace, Heroult type, for making steel.

Two Volta furnaces are making ferrosilicon and ferrochromium for two Canadian companies.

In Canada the industry shows a net gain of 7 furnaces in 1921. The actual gain is larger, but the total increase is explained in part by the fact that a more complete report of the Volta and other installations was possible the past year than the previous one. Our record shows 50 furnaces in Canada on Jan. 1, 1922, as against 43 on Jan. 1, 1921; 19 on Jan. 1, 1917 and only 3 on July 1, 1913.

The net increase in the two countries has been 39

Table of Heroult Electric Furnaces made by American Bridge Co., New York, and sold to the following, up to Jan. 1, 1922.

Company and Location	No. of Furnaces	Size, Tons	Product
Alaska-Treadwell Gold Mining Co., Treadwell, Alaska	1	2	Castings
American Manganese Steel Co., Oakland, Cal.	1	3	Castings
American Manganese Steel Co., Chicago Heights, Ill.	2	3	Castings
American Manganese Steel Co., Chicago Heights, Ill.	1	6	Castings
American Steel Foundries, Indiana Harbor, Ind.	1	6	Castings
Anniston Steel Co., Anniston, Ala.	5	6	Castings and pig iron
Armstrong, Whitworth of Canada, Ltd., Longueil, Que.	1	3	Ingots
Armstrong, Whitworth of Canada, Ltd., Longueil, Que.	3	6	Ingots
Atlantic, Gulf & Pacific Co., Manila, Philippine Islands	1	1	Castings
Atlas Crucible Steel Co., Dunkirk, N. Y.	1	3	Ingots
Atlas Crucible Steel Co., Dunkirk, N. Y.	2	6	Ingots
Baldwins Canadian Steel Corp., Ltd., Toronto, Can.	7	6	Ingots
Best Steel Castings Co., Oakland, Cal.	1	6	Castings
Bethlehem Steel Co., Bethlehem, Pa.	1	3	Castings
Bethlehem Steel Co., Bethlehem, Pa.	1	6	Ingots
Braeburn Steel Co., Braeburn, Pa.	2	6	Ingots
Buckeye Steel Casting Co., Columbus, Ohio	2	6	Castings
Carbon Steel Co., Pittsburgh, Pa.	1	6	Ingots
Carnegie Steel Co., Duquesne, Pa.	1	25	Ingots
Carpenter Steel Co., Reading, Pa.	4	6	Ingots
Clark Equipment Co., Buchanan, Mich.	1	2	Castings
Clark Equipment Co., Buchanan, Mich.	1	3	Castings
Connecticut Electric Steel Co., Inc., Hartford, Conn.	2	2	Castings
Crane Co., Chicago, Ill.	1	6	Castings
Crucible Steel Casting Co., Cleveland.	1	1	Castings
Crucible Steel Casting Co., Lansdowne, Pa.	1	2	Castings
Crucible Steel Co. of America, Atha Wks., Harrison, N. J.	1	3	Ingots
Crucible Steel Co. of America, Atha Wks., Harrison, N. J.	3	6	Ingots
Crucible Steel Co. of America, Park Wks., Pittsburgh	2	6	Ingots
Crucible Steel Co. of America, Sanderson Wks., Syracuse, N. Y.	2	3	Ingots
Damascus Crucible Steel Casting Co., New Brighton, Pa.	1	2	Castings
Disston, Henry & Sons, Inc., Philadelphia	1	3	Ingots
Disston, Henry & Sons, Inc., Philadelphia	1	6	Ingots
Dominion Foundries & Steel, Ltd., Hamilton, Can.	2	6	Castings
Driscoll-Reese Steel Co., Hamburg, Pa.	1	1	Castings
Driver-Harris Co., Harrison, N. J.	2	2	Castings
Electric Alloy Steel Co., Charleroi, Pa.	2	6	Ingots
Electric Engineering & Foundry Co., Tacony, Pa.	1	1	Castings
Electric Steel & Forge Co., Cleveland	1	6	Ingots
Electric Steel Co. of Indiana, Indianapolis, Ind.	1	3	Castings
Electric Steel & Metals Co., Ltd., Welland, Can.	2	6	Ingots
Firth-Sterling Steel Co., McKeesport, Pa.	2	3	Ingots
Fort Pitt Steel Casting Co., McKeesport, Pa.	1	3	Castings
General Electric Co., Schenectady, N. Y.	1	5	Castings
General Electric Co., Schenectady, N. Y.	2	2	Castings
General Electric Co., Schenectady, N. Y.	1	1	Ingots
General Electric Co., West Lynn, Mass.	1	6	Castings
General Electric Co., Erie, Pa.	1	6	Castings
General Electric Co., Pittsfield, Mass.	1	1	Experimental products
Halcomb Steel Co., Syracuse, N. Y.	1	4	Ingots
Halcomb Steel Co., Syracuse, N. Y.	3	6	Ingots
Harrow Spring Co., Kalamazoo, Mich.	1	6	Ingots
Heppenstall Forge & Knife Co., Pittsburgh	1	6	Ingots
Hess Steel Corp., Baltimore, Md.	6	6	Ingots
Hub Electric Steel Casting Co., Boston	1	2	Castings
Illinois Steel Co., South Chicago	2	15	Ingots
Illinois Steel Co., South Chicago	3	25	Ingots
Illinois Steel Co., Joliet, Ill.	1	4	Molten Ferro-Manganese
Latrobe Electric Steel Co., Latrobe, Pa.	1	3	Ingots
Latrobe Electric Steel Co., Latrobe, Pa.	2	6	Ingots
Lebanon Steel Foundry, Lebanon, Pa.	2	2	Castings
Lemoyne Steel Co., Monongahela, Pa.	1	2	Ingots
Llewellyn Iron Wks, Los Angeles, Cal.	1	3	Castings
Lorain Steel Co., Johnstown, Pa.	1	3	Castings
Lunkenheimer Co., Cincinnati	1	1	Castings
Michigan Steel Casting Co., Detroit, Mich.	1	6	Castings
Michigan Steel Casting Co., Detroit, Mich.	2	3	Castings
Midvale Steel & Ordnance Co., Nicetown, Phila.	1	6	Ingots
Millbury Steel Foundry Co., Millbury, Mass.	1	2	Castings
Milton Mfg. Co., Milton, Pa	1	3	Castings
Milton Mfg. Co., Milton, Pa.	1	6	Castings
Milwaukee Steel Foundry Co., Milwaukee, Wis.	1	3	Castings
Monarch Foundry Co., Stockton, Cal.	1	1	Castings
National Malleable Casting Co., Sharon, Pa.	2	6	Castings
National Malleable Casting Co., Grant Wks, Chicago	3	6	Castings
National Malleable Casting Co., Cleveland	2	15	Castings
Newport News Shipbuilding & Dry Dock Co., Newport News, Va.	1	6	Castings
Ontario Electric Steel Co., Fulton, N. Y.	1	1	Ingots
Ontario Electric Steel Co., Fulton, N. Y.	1	6	Ingots
Pennsylvania Engineering Wks, Newcastle, Pa.	1	6	Castings
Pettibone-Mulliken Co., Chicago	1	2	Castings
Racine Steel Casting Co., Racine, Wis.	1	3	Castings
Railway Steel Spring Co., Latrobe, Pa.	1	3	Ingots
Simonds Mfg. Co., Lockport, N. Y.	2	6	Ingots
Sizer Forge Co., Buffalo, N. Y.	2	10	Ingots
Southern California Iron & Steel Co., Los Angeles, Cal.	1	6	Ingots
Southern Pacific Co., Sacramento, Cal.	1	6	Ingots and Castings
Spencer Heater Co., Scranton, Pa.	1	3	Castings
Standard Seamless Tube Co., Economy, Pa.	1	15	Ingots
Standard Stoker Co., Erie, Pa.	1	2	Castings
Taylor, W. P., Co., Buffalo, N. Y.	1	2	Castings
Taylor-Wharton Iron & Steel Co., Highbridge, N. J.	1	3	Castings
Taylor-Wharton Iron & Steel Co., Easton, Pa.	1	6	Castings
Tennessee Coal, Iron & Railroad Co., Ensley, Ala.	1	6	Molten Ferro-Manganese
Timken-Detroit Axle Co., Canton, Ohio	1	2	Castings
Timken Roller Bearing Co., Canton, Ohio	4	6	Ingots
Treadwell Engineering Co., Easton, Pa.	1	2	Castings
Trojan Electric Steel Co., Chicago	1	1	Ingots
Tungsten Steel Co., Toledo, Ohio	1	¾	Cast Tool
Twin City Forge & Foundry Co., Stillwater, Minn.	1	3	Castings
Union Electric Steel Co., Carnegie, Pa.	3	6	Ingots
Union Spring & Mfg. Co., New Kensington, Pa.	1	6	Castings
United Alloy Steel Corp., Canton, Ohio	1	6	Ingots
United Alloy Steel Corp., Canton, Ohio	2	15	Ingots
U. S. Government, Watertown Arsenal, Watertown, Mass.	1	2	Castings
U. S. Government, Watertown Arsenal, Watertown, Mass.	2	6	Ingots
U. S. Government, Naval Gun Factory, Washington, D. C.	1	6	Castings
U. S. Government, Charleston, W. Va.	3	6	Ingots
U. S. Government, Charleston, W. Va.	2	40	Ingots
U. S. Government, Charleston, W. Va.	1	1	Ingots and Experimental Products
Universal Steel Co., Bridgeville, Pa.	2	6	Ingots
Vanadium Alloys Steel Co., Latrobe, Pa.	2	3	Ingots
Vulcan Crucible Steel Co., Aliquippa, Pa.	2	3	Ingots
Warman Steel Casting Co., Los Angeles, Cal.	2	3	Castings
Warren Steel Casting Co., St. Louis, Mo.	1	2	Castings
Warren Steel Casting Co., St. Louis, Mo.	1	3	Castings

Summary:

	Furnaces
Total in the United States, including Alaska and Philippine Islands	164
Total in Canada	15
Total in the United States and Canada	179

The International Nickel Co., Huntington, W. Va., has purchased one 7-ton furnace for producing Monel metal.

furnaces in 1921 or close to 10 per cent. This contrasts with 36 in 1920; with 33 in 1919; with 31 in 1918 and with 114 in 1917.

The table of Heroult furnaces this year has been secured to date and contains all of that type now in existence or contracted for as of Jan. 1, 1922. The total of this type on Jan. 1, this year, was 164 in the United States and 15 in Canada, a net gain of 5 in the United States and a net loss of 3 in Canada, accounted for by the changes at the plant of the Baldwins Canadian Steel Corporation, Ltd., Toronto. The net gain for the total of the two countries is therefore only 2 furnaces in 1921.

Among the new Heroult installations in the United States in 1921 were the following: One 6-ton furnace for ingots at Milton Mfg. Co., Milton, Pa.; one 1-ton for castings at Electric Engineering & Foundry Co., Tacony, Pa.; one 3-ton for castings at Lorain Steel Co., Johnstown, Pa., and one 6-ton for ingots at Henry Disston & Sons, Philadelphia.

The American Bridge Co., New York, which sells the Heroult furnace, has brought out a modified design for a 7-ton furnace, the latest type. A detailed descrip-

Table of Greene Electric Steel Furnaces Installed or Contracted for in the United States and Canada, Jan. 1, 1922, as Sold by the Greene Electric Furnace Co., Seattle, Wash.

Company and Location	Size Tons	No. of Furnaces	Product
Dayton Malleable Iron Co., Dayton, Ohio	2½	1	Iron and stee
Tannent Steel & Iron Co., Tacoma, Wash.	½	2	Steel
Pacific Car & Foundry Co., Renton, Wash.	1½	1	Steel
Lamb Machine Co., Hoquian, Wash.	1½	1	Iron and steel
Aurora Foundry Co., Seattle, Wash.	2	1	Iron and steel
Everett Steel Co., Everett, Wash.	¾	1	Steel
Olympic Steel Works, Seattle, Wash.	1	1	Steel
Olympic Steel Works, Seattle, Wash.	2½	1	Steel
Vulcan Mfg. Co., Seattle, Wash.	1½	1	Iron and steel
Capitol City Iron Works, Olympia, Wash.	1½	1	Steel
Canadian Klondike Mining Co., Dawson, Y. T.	3	1	Steel
Joplin Steel & Malleable Co., Joplin, Mo.	3	1	Iron and steel
Standard Brake Shoe & Foundry Co., Pine Bluff, Ark.	2	1	Steel
Skagit Steel & Iron Works, Sedro Wolley, Wash.	1½	1	Iron and steel
Hanford Iron Works, San Bernardino, Cal.	2	1	Steel
Los Angeles Foundry Co., Los Angeles, Cal.	1½	1	Hard iron
Greene-Shaw Co., Berkeley, Cal.	¼	1	Iron and steel
Columbia Steel Co., Portland, Ore.	1½	1	Steel
Eagle Brass Co., Seattle, Wash.	250 lb.	2	Monel, iron, etc.
Special induction furnaces*		2	
Total in the United States, including Alaska, 23.			

*These are two furnaces concerning which further information is not yet available.

Table of Bennerfelt Electric Steel Furnaces Installed or Contracted for in the United States, Jan. 1, 1922, as Sold by Hamilton & Hansell, Inc., New York

Company and Location	Capacity, Lb.	Product
American Foundry & Machine Co., Salt Lake City, Utah	6600	Castings
Best Steel Castings Co., Oakland, Cal.	2200	Castings
The Parsons Co., Newton, Iowa	2200	Castings
Pacific Foundry Co., San Francisco, Cal.	750	Pig iron
Chile Exploration Co., New York City	1000	Testing
Hamilton & Hansell, New York City	500	Special testing
Oklahoma Iron Works, Tulsa, Okla.	2200	Castings
Philadelphia Electric Steel Co., Conshohocken, Pa.	2200	Castings
Simonds Steel Co., Lockport, N. Y.	500	Testing
Liberty Steel Co., Morristown, N. J.	1000	Alloy steel
A. M. Byers Co., Pittsburgh	1000	Alloy steel
United States High Speed Steel & Tool Corporation	1000	Alloy steel
United States High Speed Steel & Tool Corporation	1000	Alloy steel
United States High Speed Steel & Tool Corporation	500	Alloy steel
Haynes Stellite Co., Kokomo, Ind.	200	Nichrome
Driver-Harris Co., Harrison, N. J.	300	Nichrome
Hardite Metals Co., Long Island City, N. Y.	1000	Nichrome
Vaughan Motor Works, Portland, Ore.	500	Steel castings
Total in the United States, 18.		

Table of Snyder Multi-Phase and Single-Phase and of Von Schlegell Repelling Arc Type Electric Steel Furnaces Installed or Contracted for in the United States and Canada, Jan. 1, 1922

Company and Location	Size, Tons	No. of Furnaces	Product
Snyder-Multi-Phase:			
Dayton Steel Foundry Co., Dayton, Ohio	5	1	Steel
West Steel Casting Co, Cleveland	5	1	Steel
Joyce-Cridland, Dayton, Ohio	3	1	Steel
Zimmerman Steel Co., Bettendorf, Iowa	5	1	Steel
Atlantic Foundry Co., Akron, Ohio	3	1	Steel
Standard Steel Castings Co., Clearing, Ill.	5	2	Steel
Buckeye Traction Ditcher Co., Findlay, Ohio	1	1	Iron and steel
Hubbard Steel Foundry Co., East Chicago, Ind.	5	1	Steel
Niagara Elec. Steel Corporation, No. Tonawanda, N. Y.	1	1	Steel
Western Crucible Steel Cast. Co., Minneapolis, Minn.	3	1	Steel
The Denver Rock Drill Mfg. Co., Denver, Col.	¾	1	Steel
Industrial Steel Casting Co., Toledo, Ohio	2	1	Steel
Standard Steel Casting Co., Cleveland, Ohio	3	1	Steel
Chicago Steel Foundry Co., Chicago	3	1	Steel
W. K. Henderson Iron Works & Supply Co., Shreveport, La.	1½	1	Steel
Von Schlegell Repelling Arc Type:			
H D. Stroud, Detroit, Mich.		1	Alloy Steel
Snyder Single-Phase:			
Crucible Steel Casting Co., Milwaukee, Wis.	1	1	Steel
Dayton Steel Foundry Co., Dayton, Ohio	1	1	Steel
S. Fair & Son, SaginawMich.	¾	1	Steel
Western Crucible Steel Casting Co., Minneapolis, Minn.	1	1	Steel
Monroe Steel Casting Co., Monroe, Mich.	1	1	Steel
Sivyer Steel Casting Co., Milwaukee, Wis.	1	1	Steel
Otis Elevator Co., Buffalo, N. Y.	5	1	Steel
Minneapolis Elec. Steel Cast. Co., Minneapolis, Minn.	¾	1	Steel
Gerlinger Steel Casting Co., Milwaukee, Wis.	¾	1	Steel
Amer. Well & Prospecting Co., Corsicana, Texas	¾	1	Steel
Otis Elevator Co., Buffalo, N. Y.	5	1	Steel
Haynes Stellite Co., Kokomo, Ind.	¾	3	Stellite
Niagara Elec. Steel Corp., No. Tonawanda, N. Y.	¾	1	Steel
Chile Exploration Co., New York, N. Y.	3 & 1	2	Steel
Davidson Mfg. Co., Montreal, Canada	1	1	Steel
Electric Steel Co., Chicago, Ill.	1	1	Steel
Gerlinger Steel Casting Co., Milwaukee, Wis.	1	1	Steel
Manitoba Steel Foundry, Selkirk, Manitoba, Can.	1	2	Steel
Pelton Steel Co., Milwaukee, Wis.	3	1	Steel
New London Ship & Engine Co., Groton, Conn.	1	1	Steel
Stearnes Rogers Mfg. Co., Pueblo, Col.	¾	1	Steel
Electric Steel Co., Chicago, Ill.	3	1	Steel
Fairbanks Steam Shovel Co., Marion, Ohio	1	1	Steel
Beaumont Iron Works, Beaumont, Texas	1	1	Iron and Steel
W. K. Henderson Iron Wks. & Supply Co., Shreveport, La.	¾	1	Steel
United Alloy Steel Corp., Canton, Ohio	1	2	Alloy Steel
Western Steel Car & Foundry Co., Hegewisch, Ill.	1	2	Steel
Oil Well Supply Co., Oil City, Pa.	¾	1	Steel
Fluid Compressed Steel Co., Keokuck, Iowa	1	1	Steel
Industrial Steel Castings Co., Toledo, Ohio	2	1	Steel
H. Lifchits Brass Foundry & Machine Shop, Indianapolis, Ind.	¾	1	Steel

Total in the United States, 52; Canada, 2.

tion of this will be published in a later issue of THE IRON AGE.

Conspicuous among sales of new furnaces in 1921 is the Greene with the reported sales of 5 furnaces as follows: Los Angeles Foundry Co., Los Angeles, Cal., one 1½-ton furnace for hard iron; Greene-Shaw Co., Berkeley, Cal., one ¼-ton for iron and steel; Eagle Brass Co., Seattle, Wash., two 250-lb. furnaces for monel metal, iron, etc., and the Columbia Steel Co., Portland, Ore., one 1½-ton for steel.

The Greaves-Etchells furnace is credited with three new installations in 1921. Though not large in number these are significant as marking a contract for the largest electric furnace ever built and also as revealing plans for the largest electric steel plant in the country though definite announcement of this has not been made. The three new contracts referred to are two 10 to 15-ton furnaces and one 50 to 60-ton furnace for the Ford Motor Co. These supplement a 3-ton and a ½-ton of the same type in use for some time.

For the first time it is possible to publish a table of the installations of Volta furnaces. Previous to this only estimates have been available. Of these there are 2 in the United States and 11 in Canada, the furnace being distinctly a Canadian development.

The table of general furnaces includes some that were not published a year ago, mostly Canadian installations. These are based on Canadian Government records and account in part for the net increase in furnaces in Canada for 1921.

Data regarding the Moore and Pittsburgh furnaces were unobtainable from the sellers as in previous attempts to compile this review, but from data obtained from several sources it is possible to publish this year our estimate which is probably nearer the total than in past years. This estimate credits this type of furnace with 36 furnaces as contrasted with 24 a year ago.

An interesting fact is the sale of two Detroit rocking furnaces in 1921 for use in the iron industry. This is primarily a non-ferrous electric melting furnace. The new installations include one 1-ton furnace, 300 k. v. a., at the Homestead Valve Mfg. Co., Homestead, Pa., for making gray iron and semi-steel valve bodies and one 1-ton furnace, 300 k. v. a. for producing gray iron and semi-steel castings.

One new installation of a Rennerfelt furnace is reported for 1921 at the plant of the Vaughan Motor

Table of the Number of Electric Steel Furnaces in the United States and Canada

Type	U. S. Jan. 1, 1922	Canada, Jan. 1, 1922	U.S.& Canada, Jan. 1, 1922	U.S.& Canada, Jan. 1, 1921	U.S.& Canada, Jan. 1, 1920	U.S.& Canada, Jan. 1, 1919	U.S.& Canada, Jan. 1, 1918	U.S.& Canada, Jan. 1, 1917
Heroult	164	15	179	177	170	163	146	84
Snyder and Von Schlegell†	52	2	54	54	40	48	35	22
Rennerfelt	18	0	18	17	18	13	13	13
Greaves-Etchells	26	2	28	25	18	11	12	0
Grönwall-Dixon	11	1	12	12	13	13	12	9
Ludlum	13	0	13	13	12	11	6	5
Girod	5	0	5	5	5	5	5	4
Booth†	14	0	14	14	12	11	4	0
Moore*	36	0	36	24	20	12	4	0
Induction	3	0	3	3	3	3	3	3
Webb	2	0	2	2	2	2	2	0
Stassano	1	0	1	1	1	1	1	1
Greene	23	0	23	18	11	8	1	1
Vom Baur	6	0	6	5	4	2	0	0
Wile	0	0	0	0	0	0	1	1
Detroit	3	0	3	1	1	0	0	0
Volta	2	11	13	8	...	...	...	...
Special, etc.*	9	19	28	20	24	27	24	12
Total	388	+ 50 =	438	399	363	390	269	155

*Estimated.
†No report: data left same as year ago.

Table of Electric Steel Furnaces Installed or Contracted for in the United States and Canada, Jan. 1, 1922, other than the Heroult, Snyder, Rennerfelt, Gronwall-Dixon, Greaves-Etchells, Greene and Booth Types

Company and Location	Size, Tons	No. of Furnaces	Type
Bethlehem Steel Co., South Bethlehem, Pa.	10	1	Girod
Washington Iron Works, Seattle, Wash.	3 & 1	2	Girod
Electric Steel Foundry, Portland Ore.	1	2	Girod
Washington Steel & Ordnance Co., Washington, D. C.	1	1	Stassano
American Iron & Steel Mfg. Co., Lebanon, Pa.	20	2	Induction
General Electric Co., Pittsfield, Mass.	2	1	Induction
Ludlum Steel Co., Watervliet, N. Y.	10	3	Ludlum*
Metal Alloys, Inc.	5	3	Ludlum
Hammond Steel Co., Syracuse, N. Y.	10	1	Ludlum
McCord Mfg. Co., Chicago	6	2	Ludlum
American Cast Iron Pipe Co., Birmingham, Ala.	6	1	Ludlum
Omaha Structural Steel Works, Omaha, Neb.	2	1	Ludlum
Westinghouse Electric & Mfg. Co., Trafford, Pa.	6	1	Ludlum
Bonney-Floyd Co., Columbus, Ohio	3	1	Ludlum
Old Dominion Iron & Steel Corporation, Richmond, Va.	3	2	Webb
Hercules Steel Casting Co., Milwaukee, Wis.	6	1	Vom Bauer†
Moreland Motor Truck Co., Los Angeles, Cal.	3	1	Vom Bauer
Moreland Motor Truck Co., Los Angeles, Cal.	¾	1	Vom Bauer
A Steel Casting Company, New York City	3	1	Vom Bauer
Rhode Island Crucible Steel Co., Providence, R. I.	1½	1	Vom Bauer
Nitrogen Corporation, Providence, R. I.	¾	1	Vom Bauer
Michigan Steel Castings Co., Detroit, Mich.	1	1	Detroit
Homestead Valve Mfg. Co., Homestead, Pa.	1	1	Detroit
Russell Wheel & Foundry Co., Detroit, Mich.	1	1	Detroit.
Onondaga Steel Co., Syracuse, N. Y.	1	1	Special
Chrome Steel Works, Chrome, N. J.	1	1	Special
Tivani Electric Steel Co., Belleville, Ont.	3	1	Special
Hesse-Martin Iron Works, Portland, Ore.	1	1	Special
Thos. Davidson Mfg. Co., Montreal, Que.	8	4	Special
Thos. Davidson Mfg. Co., Montreal, Que.	1½	1	Special
Canadian Electric Steel, Ltd., Montreal, Que.	7	3	Heroult modified
Canadian Brake Shoe Co., Sherbrooke	1	1	Special
Canadian Brake Shoe Co., Sherbrooke	2	3	Special
Hull Iron & Steel Foundries, Ltd., Hull	6	1	Heroult modified
Baldwins Canadian Steel Corporation, Collingwood	3	1	Heroult modified
Canada Electric Castings Co., Ltd. Orillia	1½	1	Special
Manitoba Steel Foundries, Ltd., Winnipeg	2	2	Special
Opsal Steel Co., Vancouver, B. C.	2½	1	Special
Shipton Electric Pig Iron & Steel Co., Ltd., Vancouver, B. C.	1	1	Special
Other special furnaces, estimated		5	Special

Tota in United States and Canada: Girod, 5; Stassano, 1; Induction, 3; Ludlum, 13; Webb, 2; Vom Bauer, 6: Detroit, 3; Special and Heroult modified, 28. *Total*, 6.

*A Ludlum 3-ton furnace has been sold to the Consolidated Rolling Mills & Foundry Co., Inc., New York, for installation in Chile. There are also 9 Ludlum furnaces of special type making various ferroalloys for the Metal Alloys, Inc., Watervliet, N. Y. The Andes Electin Corporation, Coney Island, N. Y., also is using a special 3-phase Ludlum furnace for smelting tin ores.

†Four Vom Bauer furnaces have been sold for installation in Japan, one 6-ton furnace to Le Flaive et Cie., St. Etienne, France, and one 3-5 ton furnace to Consolidated Rolling Mills & Foundries Co., Mexico City, Mexico, for castings.

Works, Portland, Ore. It is a ¼-ton furnace for steel castings.

No data were available from the sellers of the Von Schlegell or Booth furnaces. Statements were received that there had been no change in the Ludlum, Snyder or Grönwall-Dixon lists as published a year ago.

One of the tables shows the number of furnaces by types in the United States and Canada as of Jan. 1, 1922, as well as the total of the two countries, compared with recent years.

Developments in the World

NO attempt has been made this year to obtain data regarding the progress of the electric steel industry in other countries than the United States and Canada. It is probable that this will be possible later. In this review published Jan. 6, 1921, covering the year 1920, data regarding the various types of furnaces in these countries were published including a table which gave known and estimated figures for all countries and all types. According to this there were 562 electric furnaces of all types outside the United States and Canada. Of these 131 were Heroult, 85 were Rennerfelt, 65 were Greaves-Etchells, 7 were Snyder and 6 were Vom Baur, with other types estimated at 268. England led with 150, Germany following with 100 and France with 69 furnaces. Italy and Sweden were credited with 50 each, Norway and Austria (with Hungary) with 20 each, Japan with 11 and Spain and Luxembourg with 10 each.

It is known that these totals have been increased recently so that it is safe to say that, allowing for additions and discontinuances and adding the present total of 438 in the United States and Canada, the world's total is easily 1000.

Of the total installations the United States is credited with 388 or practically 39 per cent. In the production of steel and iron in electric furnaces, this country easily leads all the rest with a capacity probably equal to the total of the other countries combined.

Outstanding in the progress of 1921 is the introduction of the electric furnace into the manganese steel and the gray iron foundry industry—a movement sure to expand.

Hope for Improvement in Export Business

No Decided Change Is, However, Expected This Year Owing to Disturbed Conditions in Europe— Japan a Good Customer

FOR American exporters, 1921 was largely a year of liquidation and retrenchment. A number of prominent exporting companies liquidated, many smaller exporters reduced their personnel to a minimum and several American branches of foreign export houses were closed because of the depressed condition of business. Although the majority of exporters look forward to the coming year as a period of improvement, but slight approach to normal business is expected in view of the unsettled condition of almost all foreign markets.

Throughout the past year, Japan has been practically the only active market and this situation is expected to continue for the greater part of next year. In the first quarter, Japanese buying assumed fairly large proportions, continuing until about June when the effect of German competition began to be felt by traders with the Far East. At this time it was variously estimated by Japanese exporters that from 70 to 80 per cent of Japanese buying was being done in the United Kingdom and Continental markets, the remainder coming to the United States. This competition was confined to a great extent to light rails, bars, wire and wire products. The report of a Japanese warehouse company on warehouse stocks for the first ten months of this year shows a decrease in the value of iron and steel on hand. Compared with this company's figures for November, 1920, when warehouse stocks were estimated at about 57,000,000 yen ($27,360,000), November, 1921, showed stocks in warehouses of the principal ports and cities, valued at about 19,000,000 yen ($9,120,000).

Japan Purchases Sheets

Japan purchased about 54 per cent of the sheet exports of this country during the first 10 months of the year. The majority of these orders were for Nos. 31 and 31½ gage black sheets, much of the business in heavier gages going to British mills. A large part of these sheets was galvanized in the Japanese galvanizing plants. To protect this infant industry, a duty of about 30 yen ($14.40) per ton is imposed upon imports of galvanized sheets, compared with about 5.50 yen ($2.64) per ton on plain black.

Imperial Government purchases have been largely confined to rails and locomotives. The year's purchases for the Imperial Government Railways alone are estimated to total about 50,000 to 60,000 tons of 60-lb., 75-lb. and heavier rails and light rail purchases were swelled by both Government and private buying. Although buying of copper was fairly active during the year, the total shipments during the first ten months placed Japan in fourth place among foreign buyers of American copper. For a short time, activity was noted in structural material for bridges, which were being erected to replace old bridges in the vicinity of Tokio. More than a dozen bridges were purchased in the United States, which represents only a small percentage of the total of more than a thousand, which will eventually be bought for erection in and near Tokio. Construction of new buildings in Tokio, Osaka and other large cities resulted in a few tonnages of structural steel and as the trend toward modern fire-proof office buildings in Japan is evidently continuing, the ensuing year may see further purchases for this purpose.

Large Electrical Equipment Contract

One of the largest contracts placed in the United States during the year was for about $2,000,000 worth of electrical equipment, awarded by the Tokio Electric Light Co., to the Westinghouse International Co. Another smaller order called for about $600,000 worth of equipment for the Daido Electric Power Co. Electrification of the Government railroads is in progress, opening prospects for future purchases, many of which may be made in the United States. In addition to previous rail purchases made by the Imperial Government Railways, about 13,000 tons of 60-lb. and 75-lb. rails was awarded during the last week of December by the Government and decision was also made on the purchase of 5500 tons of 100-lb. rails for the Hanshin Electric Railway.

The South Manchuria Railway Co., Japanese owned, placed a number of orders in the United States during the year. The purchasing of this railroad, which is fairly regular, averages between 350,000 yen ($168,000) and 400,000 yen ($192,000) per month. In 1919 purchases totaled about 10,600,000 yen ($5,088,000) and in 1920 about 6,146,186 yen ($2,950,169).

These purchases did not include buying done in the United Kingdom, Germany and elsewhere. In prospect for 1922 is the material for hydro-electric projects, particularly a large one on the island of Formosa, material for the electrification of railroads in Japan, structural steel for bridges, new office buildings and other buildings in the cities, the usual rail requirements of the Government railroads, municipal street car lines and private mining, lumbering and other enterprises and the usual consumption of black sheets. A number of sheet orders have been booked by Japanese export houses and placed with American mills for January-February delivery, as well as orders for wire and wire nails.

South American Conditions

Early in 1921, South American markets were in a chaotic condition, practically all the principal ports of South American countries being congested with canceled material. The greatest supplies were at Buenos Aires, where the two leading interests and numerous small exporters were holding stocks of canceled material. While a large part of this material was rendered practically useless by exposure to the weather, some was sold at heavy losses and a not inconsiderable part is reported to have been re-exported to other markets. Gradually the situation was cleared and although South American markets will probably not enter into American exports as a factor in 1922, there will undoubtedly be some purchasing on a scale slightly greater than in 1921.

Construction contracts have been let to American builders in Chile, Brazil, Bolivia, and Argentina and other countries and the development of oil fields in Chile, Argentina, Bolivia and Venezuela will doubtless result in the exportation of oil well equipment, tanks, pipe and pumping machinery. The Westinghouse International Co. received part of a railroad electrification contract for Chile, the locomotives being awarded to the American Locomotive Co. The Chilean State Railways closed on about 20,000 tons of heavy rails and about 400 cars in November, placing the rails in Germany, for the first time in about 20 years, and the cars with two American builders. A project is reported from Colombia for railroad construction, which, if carried through, would eventually involve the purchase of a large tonnage of heavy rails as well as locomotives and cars. This project is in line with the Colombian Government's intention of spending the $25,000,000 indemnity for Panama, when it is received from the United States Government. The railroad contract for 128 miles of standard gage track, on which the Ulen Contracting Co., New York, is working in Bolivia, will result in inquiries, according to the contractor, in February or March, when the engineering is completed and construction begins. A number of steel bridges and a tonnage of 60-lb. rails will be included.

Locomotives for Mexico

The National Railways of Mexico have purchased a total of 216 locomotives, heavy and light, of which slightly less than half were second-hand. Rail requirements have been handled satisfactorily by the Monterey Iron & Steel Co., which is at present engaged in executing an order for about 25,000 tons of rails for the Mexican railroads. The Mexican railroads are in need of adequately equipped repair shops. Although there is an ample supply of standard gage freight cars for present conditions, standard gage passenger coaches and narrow gage passenger coaches and freight cars are needed. Purchases, however, can only be made when generous credit terms are extended.

Early in the year Germany was not yet a large factor in international markets, but by June, competition of German products was being rather severely felt by American exporters. A number of fairly large rail and structural steel orders were booked and the Japanese, who had been notably active in purchases of wire and wire products in the United States, began buying in Germany and England, because of lower prices. The low quotations made by German wire mills stimulated an interest among American consumers and negotiations were instituted on several large wire nail orders.

Policy of German Companies

Although numerous representatives of German mills and export houses have established themselves in New York this year, the depressed condition of the American market has precluded any large transactions, but there has been some activity on the part of American exporters, who have purchased German material for shipment to foreign markets. The large German interests, such as those of Stinnes and Thyssen, do not look with favor upon any attempt to export iron and steel to the United States on a large scale, believing that such business would not be sufficiently remunerative or last sufficiently long to offset the antagonism that would be aroused.

Following the short period when German mills were booking orders from all markets, the decline of the mark stimulated not only foreign but domestic German purchasing. Exporters and dealers in Hamburg, Rotterdam and other ports filled available warehouses with material to replace their paper marks, which were daily declining in value. This unusual buying activity served to stimulate German prices and as the American iron and steel market declined, the German market rose. To-day, from a price standpoint, Germany is competing with American products in foreign markets on a very much reduced price margin. German interests during the year accepted a number of orders, chiefly for railroad material and equipment and agricultural machinery, from the Russian Soviet Government, extending long terms of credit.

Railroad Material for China

China became active for a short period during the year, purchasing rather heavily of railroad material and equipment. Heavy rails and a large number of locomotives and cars were placed in the United States, but on some of this material, difficulty has been encountered by the sellers in finding financing. China was also active for a short time in purchasing copper for minting, but the unstable political situation curtailed this considerably. Several large tonnages of second-hand plates and shapes, used extensively by Chinese blacksmiths, were shipped by American exporters and Chinese buyers inquired in most cases unsuccessfully for wire shorts. There was some activity in electric units and machinery and machine tools.

Some sales of imported semi-finished material have been made in the American market during the year and a considerable tonnage of pig iron has been sold on the Pacific Coast, where high railroad freights eliminated Eastern iron. According to Paul G. Leoni of the Iron & Ore Corporation of America, 11 Broadway, New York, an active importer of foreign pig iron and some semi-finished material during the past year, there have been imports from Belgium, Luxemburg and Germany but most of these sales were made in September and October, when American pig iron was higher and European iron cheaper. Pig iron sales were then made at $18 to $19 per ton, c.i.f. Atlantic ports and $26 to $30 per ton, c.i.f. Pacific ports. Since then the situation has changed. American prices have declined and European prices increased and since November none of the negotiations for foreign pig iron, which were pending, has led to any results, nothwithstanding reports to the contrary.

Outlook for This Year

At present, European prices are about $17 to $18 per ton, f.o.b. European ports, and as the freight rate to Atlantic ports is about $4, the delivered prices cannot compete with the American quotations, except, perhaps, in special cases where the consumer is located close to a port. On the Pacific Coast there is still an advantage in importing European pig iron and several sales were made during December at prices between $24 and $26 per ton, c.i.f. port. The outlook for 1922 depends on the developments in both the European and American markets. It is, however, likely that there will be a close race between foreign and domestic pig iron and there may be times when importation will be possible.

However, if the new tariff goes through, providing a duty on pig iron of $1.25 per ton, the chances for importing foreign pig iron in the East will not be great.

Movement of Foreign Ores

Imports of iron ore are also dependent upon freight rates. European iron ore, suitable for making foundry iron can be imported at from 8c. to 9c. per unit, c.i.f. Atlantic ports and in view of the special freight rates on imported ores, which have been established lately for Virginia and Pennsylvania points, some business in foreign ore may be expected when demand increases.

Low phosphorus iron ore is quoted at present between 10c. and 25c. per unit, according to quality, but no sales of any importance have been effected, because of the lack of demand for low phosphorus pig iron.

British Iron and Steel in 1921

The Slump in Output and Prices—Continental Competition—Conditions Nearing Normal as Year Ends

LONDON, ENGLAND, Dec. 15.—Since the slump of 1879 which still lives in the memory of British ironmasters as the most disastrous period in the history of the trade, no more difficult times have ever been experienced than those through which the iron trade has passed during the last 12 months. The transition from prosperity to acute depression came with almost the rapidity of a thunderbolt. Production has fallen to the lowest level recorded for several decades, and the collapse in prices has been wholly unprecedented since the iron industry was established.

The Slump in the Industry

It was of course the inflation of values which in the first instance was responsible for the slump. Prices had reached an impossible level. Foreign consumers with depreciated exchanges were simply unable to pay the price for British iron and, in consequence, we have witnessed an almost complete surrender of our overseas trade.

But that does not mark the full extent of the blow. Cleveland, our leading producing area, has not only lost its overseas markets, which in pre-war days represented a trade of about 750,000 tons per annum, but in addition the home markets have been invaded and for months past our ironmasters have had the mortification of witnessing a constant influx of pig iron pouring into the Tees from continental ports, while their own blast furnaces were standing idle. For months past also Cleveland has been shut out of the Scottish market which has always been the mainstay of the local pig iron trade.

This diversion of the normal flow of trade has been entirely attributable to the fact that France, Belgium and Germany, aided by the vagaries of falling currencies, have been able to undersell us both at home and abroad, and the effect of this is seen in the fact that whereas the exports of pig iron from the Tees during the 12 months ended Oct. 31, 1920, were 470,794 tons, they fell in the ensuing 12 months to 125,730 tons, while the imports from abroad, which in the 12 months ending Oct. 31, 1920, amounted to the negligible quantity of 4,668 tons, reached in the ensuing 12 months 78,293 tons. Indeed, in the latter months of the year the imports far exceeded the shipments both to foreign and home ports.

High prices in the first instance precipitated the slump and it is true that, even before the coal strike, many furnaces had been put out of blast, the position being that on the day before the miners ceased work only 41 furnaces were operating on the Northeast Coast, against a normal average of 72. But the plunge to disaster was rendered deeper and more rapid by the ill-advised action of the coal miners in their declaration of industrial war.

The Pig Iron Output

The miners themselves suffered severely but their own sufferings were as nothing to those inflicted upon the iron and steel trade and upon those who depended upon it for a livelihood. For three months the industry was entirely at a standstill and, even after the miners got back to work and fuel was again available, very little pig iron was produced on the Northeast Coast and in October, which is the last month for which the figures of production are available, the total output of pig iron was less than half the quantity produced in March, the month preceding the coal strike.

The Cleveland pig iron output for the year is likely to be no more than 40 per cent of the production in 1920. The furnaces now in blast number 24, whereas at the end of 1920 there were 72 in operation and the chief problem engrossing the minds of ironmasters at the present moment is how to get these idle furnaces back to work again. It is simply a question of prices. There is no sentiment in business and if the British or foreign consumer finds that he can buy continental iron cheaper than Cleveland iron, nobody expects him to be patriotic at the expense of his pocket. Indeed, the local steel makers themselves, though in most cases owning their own blast furnaces, have preferred to keep their blast furnaces idle, and to use foreign pig iron and scrap, rather than face the high costs of production involved in smelting their own pig iron.

Extent of the Price Decline

The great problem therefore has been to reduce prices, and in this direction remarkable results have already been achieved. At the beginning of the year No. 3 Cleveland G. M. B. pig iron was quoted at 225s per ton; today it is offered at 100s and even yet the trade is convinced that the end of the downward movement is not reached. This rapid descent to the lower level of values has only been rendered possible by the sacrifices of employers and employed.

The ironmasters have not only abandoned all profits but are actually now producing at a loss, while the wages of the blast furnacemen have fallen from 170¼ per cent above the standard to 77¼ per cent above it. Equally drastic have been the sacrifices made by the Cleveland ironstone miners. Their wages have fallen about 9s per day and they have further voluntarily agreed to sacrifice a guaranteed minimum of 8s per day, consenting to the regulation of earnings entirely by output as a further means of assisting the revival of industry. Even yet prices have not fallen to such a level as to shut out foreign pig iron, except perhaps in the Tees ports.

In other areas the high cost of transport added to the price of Cleveland pig iron brings up the figure to such a level that the foreigner can still compete successfully. The costs of production are steadily falling and it is hoped that the railroad companies will promptly make substantial reductions in rates. Moreover, fuel costs are dropping and the day seems now not far distant when British furnaces will be able to cope successfully with foreign material.

At the beginning of the year there was an export premium of 22s 6d per ton on Cleveland pig iron; that is to say, the Cleveland makers demanded 22s 6d per ton more from the foreigner than from the home consumer. On Jan. 7 the export premium fell to 20s per ton, and on Jan. 25 it fell to 5s per ton. Since then there have been occasional periods when iron was offered at home and abroad at the same figure but for the most part the export premium was maintained at 5s per ton. The following table shows the price changes in shillings during the year so far as they relate to No. 3 Cleveland G.M.B. which is the standard quality upon which all wage ascertainments are based:

1921	Home	Export
Jan. 1	225	247½
Jan. 7	215	235
Jan. 25	215	220
Feb. 1	195	200
March 1	150	155
April 5	120	125
Nov. 1	110	115
Nov. 28	100	105

It should be added, in explanation of the above figures, that they are the official minimum prices agreed upon by the Cleveland ironmasters committee and, during the scarcity occasioned by the coal strike, the price of No. 3 actually ran to 140s but speedily relapsed when production was resumed.

The following summary compares the average officially ascertained price of No. 3 Cleveland G.M.B. in the past two years:

	1920 s.	1920 d.	1921 s.	1921 d.
First quarter	178	3.18	198	1.31
Second quarter	203	8.96	126	11.56
Third quarter	217	6.31	131	6.13
Fourth quarter	224	5.37	...	...
Year's average	205	11.95		

The Steel Situation

As regards the steel industry, the beginning of the year found makers with clean order books and prices somewhat removed from the highest levels reached in 1920, but still exorbitant. The boom of the previous year had enabled makers to become independent and to put up prices heedless of what the future would bring. Costs were undoubtedly high, but there was little justification for maintaining selling values at such levels. Taking into consideration the fact that continental works were beginning to get into swing again, one would have thought that the steel makers would have made some attempt at any rate, to avoid what was the natural course of events, namely, acute continental competition, by making drastic reductions, but this was not the case and throughout the year steel prices in this country have simply been cut by driblets, except toward the close, when a bold bid was made. Continental competition began to make itself felt in January, taking the form of undercutting in the sheet trade, and our old overseas markets were temporarily lost to us, heavy tonnages finding their way to foreign destinations, chiefly South America and the Far East. Subsequently good railroad material orders were booked by the continent and plants here began to shut down for want of orders.

The Coal Strike

With the government control of the coal industry coming to an end on March 31, the coal miners declared war on the nation and thereby struck the greatest blow to the steel trades. Most works had to shut down entirely and production in consequence fell to practically nothing. When the strike was settled three months later, steel makers found themselves with empty order books and thoughts concentrated upon where business was to come from and how they were to get their prices down. During the period of complete stagnation, continental works saw their opportunity and with the rate of exchange favorable to them, very large quantities found their way to other foreign markets while such home consumers as were enabled to carry on were forced to import their supplies from abroad. These latter sales consisted in large part of semi-finished steel. Subsequently, Belgium began to have industrial troubles and other continental countries, from one cause or another, got very much behind hand with deliveries of finished material and, as in most cases the steel was required urgently, a number of orders were cancelled and were booked with works here though at slightly higher figures.

In semi-finished steel, however, British prices fell to competitive levels with the result that continental sales in this direction diminished and gradually ceased. In November British steel makers of shapes, etc., finding that there were orders to be had, abandoned ideas of profits and made cuts which, though insufficient to oust continental competition, nevertheless gave certain buyers a little more confidence and orders began to dribble in again, though only sufficient to keep plants partly employed.

In Scotland where the depression had been at its worst, the placing of the Admiralty contracts for three new capital ships, had caused a certain amount of encouragement and employers and employees alike were looking to activity for some time. The suspension of these orders, however, as a result of the naval holiday proposed by the Washington Conference brought disappointment. This feeling, however, was soon overcome, it being realized after all that the limitation of armaments would in the end prove not only a benefit to the nations but to the steel industry as well.

Throughout the whole year shipbuilding, generally speaking, has been stagnant so far as new orders are concerned and ship repairs were sent freely to the continent, where they could be effected at probably half the home cost.

Activity in Tin Plate

An exception to these remarks must, however, be taken with regard to the tinplate industry. Upon the cessation of the boom in 1920, prices began to fall and whereas 77s a basis box was the highest price paid by December of that year, values had fallen to 33s basis. This year, except for minor fluctuations, quotations have dropped and a basis box is now worth about 21s. The trade of course suffered severely during the coal strike, but recovered comparatively rapidly, there being no competition to meet except from America. True, Germany was a seller at one time at competitive prices, but heavy tonnages changed hands, and to-day Wales stands as the cheapest seller. Export business has been moving better, but has naturally been limited in the case of those markets where the exchange rates are adverse. The Far East has been quite a fair buyer, but latterly the demand from that quarter has subsided. Much encouragement given to Wales was the securing of 150,000 boxes for British Columbian packers in face of keen competition from United States manufacturers.

Comparative Prices

The following are comparisons of prices per ton of leading iron and steel products:

	December, 1920 £	December, 1920 s.	December, 1921 £	December, 1921 s.
Steel ship plates	25	0	10	10
Steel joists	24	0	10	0
Steel rails (heavy)	25	0	10	0
Steel billets	15	10	7	10
Marked bars (Staffs)	33	10	16	10
Tinplates, 20 x 14', basis f.o.b. (per box)	1	13	1	1

In connection with the study of corrosion of metals in mine water, 44 specimens of material received from 25 manufacturing companies co-operating in the mine-water tests have been weighed, checked, numbered and polished at the Pittsburgh experiment station of the Bureau of Mines, and placed in certain mines where they will remain possibly six months.

German Industry Had Prosperous Year

Booked into 1922 but Speculative Character of Business May Result in Some Cancellations— Details of German Exports

(Special Correspondence)

BERLIN, GERMANY, Dec. 9, 1921.—When the history of the German iron and steel industry comes to be written, 1921 will figure as one of the most remarkable years on record. On casting a retrospective glance on the trend of developments during this year, two distinct periods—linked by a short transitional period—may be observed. If developments were to be depicted in a curve, the graph to be plotted would somewhat resemble a parabola with the origin representing the turn of the tide toward the end of May.

The opening of the year found the industry in a fairly satisfactory position, as mills were on the whole still well employed on old contracts. Warehouses and producers' yards were amply stocked, prompt and quick delivery could be effected and supplies of raw material—with the possible exception of coke—were plentiful.

Official Maximum Prices Became a Farce

New business, however, left much to be desired, since consumers, in anticipation of a reduction of official prices by March, adopted a rather conservative attitude. Contrary to general assumption, the foreshadowed cut in prices in March was deferred for an indefinite period. If free market prices had fairly stabilized on the level of official maximum prices at the beginning of the year, the approaching London conference and the growing political and economic uncertainty were introducing an element of insecurity into the market. This situation became even more pronounced when the failure of the conference was realized and the sanctions of the Allies came into force. The pick-up character of business assumed decidedly grave aspects and prices began to give way. Supply and demand were once again ruling the situation and the operation of official maximum prices became a consummate farce.

The bottom point of the downward curve was reached toward the middle of May. The trend of prices in some of the principal departments is shown in the appended table, in marks per metric ton.

	Beginning of					Last Off'l Maximum
	Jan.	Feb.	March	April	May	Price
Ingots	1,850	1,800	1,750	1,750	1,400	1,370
Billets	2,075	1,950	1,950	1,900	1,600	1,995
Bar iron	2,515	2,350	2,350	2,300	1,800	2,440
Sheets, heavy....	3,125	3,000	2,700	2,500	2,100	3,090
Sheets, medium..	3,500	3,350	3,250	2,800	2,300	3,360
Plates, light	3,560	3,500	3,000	2,850	2,350	3,500
Wire rods	2,875	2,800	2,500	2,300	1,700	2,720

Revival of Activity Late in May

Though prices for some commodities receded still further during the latter half of May and even during June, a slight but none the less noticeable reaction set in toward the end of May—less reflected in a hardening of quotations than by a more active demand, especially on the part of merchants who were replenishing stocks. Furthermore, the effects of freedom from control made themselves felt at last and in conjunction with the miners' dispute in the United Kingdom and the acceptance of the ultimatum resulted in a certain consolidation of the market.

It is true that the political riots and disturbances in Upper Silesia affected the output capacity of the Silesian industry to a notable extent; so far as operations could be maintained, stocks had to be piled up at the yards because of the interrupted and disorganized transportation service. It should be borne in mind, however, that after all it is the Rhenish-Westphalian district where the center of gravity of the German iron industry rests and it is only natural that the latter profited by the elimination of the Upper Silesian factor during that period.

The upward tendency of prices received a strong impetus through the rapid deterioration of the German exchange toward the end of August and the further depreciation of the mark during the following weeks proved the general signal for an extraordinary rush for material. Available stocks were snatched up in no time, prices advanced by leaps and bounds and within a short time mills found themselves sold out for the rest of the year. Interested circles were at first inclined to predict a short life for the ensuing boom but developments up to date have proved the contrary so far. At present, mills are sold out for the first quarter and flooded with inquiries and orders for the second quarter of 1922 but are, on the whole, reluctant to enter long-term engagements on account of the uncertain raw material and exchange situation.

Business in Hands of Middlemen

The tremendous pressure of demand naturally brought about most abnormal conditions. Spot stocks have latterly been non-available and fancy prices were paid for prompt and quick delivery. As mills closed their books as far back as October and November, present business is almost exclusively handled by the second and third hand. The unparalleled soaring of prices is being viewed with much apprehension in responsible quarters, but no serious effort has so far been made to stem the upward trend.

Labor in insisting upon the reintroduction of official maximum prices takes a rather isolated stand, and when met with a counter proposal by producers and the trade suggesting the drafting of a guiding price schedule, declined to be party to any such scheme. The guiding prices fixed by the steel federation in October and subsequently readjusted in November merely represent a voluntary agreement between producers and consumers and as such do not possess legal character.

The subjoined table shows the trend of prices, in marks per metric ton, during the second period. The figures for the last two months must be considered largely nominal, as they almost exclusively represent jobbers' quotations.

Prices of Steel in Marks per Metric Ton

	Beginning of						
	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Billets	1,420	1,300	1,600	1,900	2,350	3,600	4,800
Bar iron	1,800	1,800	2,050	2,700	3,250	4,200	6,600
Sheets, heavy...	1,850	1,750	1,900	2,200	2,700	4,100	6,200
Sheets, medium.	1,900	1,800	1,960	2,500	3,100	4,600	7,400
Plates, light	2,000	1,850	2,300	3,100	3,900	5,300	14,000
Wire rods	1,700	2,000	2,050	2,700	3,000	4,650	7,300

Compared with the impetuous upward trend in the finished iron and steel market, pig iron increases were lagging behind all the time except in the last two months. Following upon the recent increase, prices have just again been raised by an average of 1000 marks per ton, the new prices being shown in the table below:

Prices of Pig Iron in Marks per Metric Ton

	Pre-war	Beginning of Jan., 1919	Jan., 1920	May, 1921	July, 1921	Nov., 1921	Dec., 1921
Hematite	79.50	314.50	1,718.50	1,816	1,816	2,700	3,891
Foundry, No. 1	75.50	250.00	1,324.50	1,560	1,560	2,200	3,326
Foundry, No. 3	70.50	249.00	1,323.50	1,484	1,484	2,124	3,250
Steel-making...	79.00	240.00	977.00	1,535	1,485	1,930	....
Spiegeleisen....	75.00	240.00	1,017.00	1,708	1,733	2,021	....

Prices for the last two grades have not been announced pending the readjustment of Siegerland ironstone prices.

After a period of suspension covering several years, German import and export statistics have made their reappearance while production statistics for 1920 and 1921 have not been published as yet. Unfortunately, the appended statistics in metric tons are not complete as the Bureau of Statistics has deferred the publishing

of the returns of the first four months in order to accelerate the issuance of the returns of the later months. For the sake of comparison, the returns for the entire year 1920 are given.

Where German Exports Went

As in 1920, Holland will probably figure as the principal export market during 1921 with 190,431 tons out of a total of 935,319 tons exported iron and steel commodities, equal to about 20 per cent. These figures refer, of course, to the period of May-September, 1921, only. The final result will probably show a noteworthy increase of tonnage shipped to the Far East but it seems rather doubtful whether any country will wrest the first place from Holland. Striking features of the returns are the heavy export of pig iron to the United Kingdom and rails and track supplies to Northern Russia during the July-September period. Broadly speaking, the largest shipments in all departments were made during August while the September figures show a slight falling off.

A detailed study of the returns shows the Saar district as the largest importer of pig iron with 21,578 tons, equal to 27 per cent of the total. The United Kingdom imported 3640 tons in August and 8360 tons in September, being the best customer in the last month. These figures are the more surprising in that shipments during former months were nil or at least insignificant.

Regarding bar iron, beams, girders, etc., Holland heads the list with 50,834 tons, or 26 per cent of the total, followed by Austria with 21,124 tons. The principal buyer of rails and track supplies was northern Russia which imported 52,354 tons (36 per cent of the total) during the July-September period, shipments in former months again being nil or insignificant. Other notable customers were Holland with 21,755 tons, Sweden with 17,719 tons, and southeastern Asia (British-India, Malacca, Ceylon, and the French, Dutch and Portuguese Indies, and the Philippines and Siam) with 16,050 tons.

Holland also lead in the sheet and plate market, her imports amounting to 25 per cent of the total German shipments; namely, 24,274 tons. Austria is second with 9347 tons. Other principal buyers, especially during the latter months, were the United Kingdom and southeastern Asia with 7837 tons and 5734 tons, respectively.

In the wire export market, the Far East and South America took a prominent place, while other noteworthy customers were the United Kingdom and Belgium. Eastern Asia (China, Japan, Hongkong, Korea) ranks foremost with 15,663 tons equal to about 20 per cent of the total, followed by Belgium with 11,707 tons, United Kingdom with 7863 tons, and South America with 7312 tons. The chief buyers of wire nails were eastern Asia and southeastern Asia with 8313 tons and 5090 tons, respectively, out of a total of 28,000 tons exported.

Financial Successes for Steel Makers

That the 1919-1920 year was a brilliant one in every respect was but feebly denied by the industry and found ample confirmation in the company reports published in the course of the last year. Though 1920-1921 was a less satisfactory year in regard to employment and sales, yet it is astounding to note that profits have rather increased than diminished. Profits and dividends of some of the principal works were as follows, figures in brackets denoting last year's returns: Phoenix 108,285,000 marks (47,687,500) and 25 (20) per cent. Gelsenkirchner Gusstahl, 12,297,000 m. (4,950,600) and 16 (10) per cent. Mannesmann Tube Co., 77,354,-500 m. (46,616,600) and 30 (20) per cent. Gutehoffnungshütte, 60,106,000 (40,550,000) m. and 24 (16) per cent. Rheinische Stahlwerke, 19,786,600 m. (14,087,-200) and 20 (20) per cent. A. E. G., 81,581,000 m. (44,675,000) and 16 (14) per cent.

Stress must be laid upon the fact, however, that mere dividend figures have ceased to be a criterion as the bulk of the profits are concealed in special reserve and sinking funds ultimately to be invested in real values, thereby evading the heavy taxation. "No piling up of paper marks"—this was the slogan of the industry throughout the year, and the reconstruction work, erection of new mills and factories, replacement of obsolete and wornout machinery by new equipment, etc., noticeable everywhere, bear testimony to its practical application. There can be little doubt that the relatively favorable financial returns of the past business year may primarily be attributed to the steadily proceeding integration and consolidation of the industry which made for the elimination of waste in every form and shape, coupled with an intensified scientific research and strenuous efforts at lowering of production costs.

Outlook Seldom So Uncertain as Now

Never has the outlook for the industry been so uncertain as at present. This may sound paradoxical in face of the period of prosperity the industry is just experiencing but is nevertheless true. The present boom is largely built up on the enormously depreciated mark and voices are already heard according to which the peak of the upward curve has now been reached. The notable appreciation of the mark during the past weeks has already had a sobering effect upon the tone of the market and the fact that recent developments at the Washington conference have caused a cancelling of steel orders placed by Japanese customers with the German industry is much commented upon.

Speculative Motives Dictate Glut of Orders

The glut of orders which has lately broken in upon the industry is largely dictated by speculative motives and the experience of 1920 when buyers cancelled orders left and right owing to the appreciation of the German currency, is still fresh in the memories of producers. History may repeat itself and there is no reason to assume that customers will be any more scrupulous than in the spring of 1920. Moreover, the separation of Upper Silesia constitutes a problem the importance of which should not be underrated. About 70 per cent of the steel and 67 per cent of the pig iron production in that province will go to Poland—not to mention the losses in coal and zinc.

Five Months' German Exports and Imports

	Imports		Exports	
	1920	May to September, 1921	1920	May to September, 1921
Pig iron, including scrap, old material, ferroaluminum, chrome, nickel, manganese, silicon and other non-malleable iron alloys	206,064	75,151	152,922	77,792
Piping and pipe shapes, made of non-malleable iron, rough and machined	11,929	5,937	22,830	14,261
Rolls, made of non-malleable iron	293	51	9,454	6,552
Machine parts, rough and machined, made of non-malleable iron	2,372	414	7,120	3,779
Other iron ware, rough and machined, made of non-malleable iron	3,793	1,552	67,500	24,174
Ingots, blooms, slabs, billets, sheet bars, rough rails, crucible steel in blooms	34,093	41,941	20,186	17,529
Bar iron, beams, girders, joists, hoop iron, structural shapes	78,460	107,093	460,278	192,267
Sheets and plates, rough, pickled, straightened, dressed, varnished	16,537	11,156	232,111	82,892
Sheets and plates, lacquered, polished, etc.; tin plate; galvanized sheets; corrugated sheets; checkered plates, etc.	3,627	4,133	15,770	12,556
Wire, rolled and drawn	14,014	12,131	83,908	73,313
Tubing and tube shapes, rolled and drawn; coiled tubes	2,221	1,547	84,021	43,299
Rails, ties, fishplates, washers	16,428	24,898	152,016	144,017
Wrought iron ware, rough and machined, including machine parts, drop forgings, buckets, lamps, containers, etc.	5,470	1,946	127,867	43,565
Total of iron and steel products	419,406	322,524	1,750,601	935,319
Value in 1,000 marks	.....	654,053	13,471,208	5,416,633

Quiet Year in Ferroalloys and Their Ores

A Review of Technical Developments and of Market Conditions—Increase in Number and Uses of Alloys with Steel

BY ROBERT J. ANDERSON

NINETEEN twenty-one was a year of great dullness in the metallurgical ferroalloy and ore industries and, as is usually the case during inactive times, prices showed much irregularity and a marked downward tendency. With steel ingot output at much less than one-half of actual capacity during the past year—and at times as low as 20 per cent—and with the widespread depression in the metal industries as a whole, it is not surprising to find the utmost stagnation in metallurgical ores and steel making alloys. While the power capacity of the electric ferroalloy plants in the United States has increased from 20,000 to 200,000 kva. in the past ten years, probably only about 20 per cent of the plants were operating in 1921.

The automotive consumption of steel has been stressed too strongly in the past. Roughly this is only about 3.5 per cent of the steel ingot production and 6.8 per cent of the alloy steel output. Of course, there is a large quantity of high speed steel normally used in machining operations, and any slump in the automotive industry is felt adversely in the ferroalloy trade. The general condition of the automotive industry is bad and the outlook is poor, and a revival is not likely for some time.

During the late war, in many countries new sources of metallurgical ores were developed, and new electric furnace alloy makers entered the field. Both these influences are likely to prove largely permanent, but it will be a long time before another boom in so-called war minerals is seen. The proposed scrapping of battleships and the ten-year naval holiday may be a bullish argument for general business but these proposals, if effected, will be adverse factors to the ferroalloy and special steel trades.

Metallurgical Progress

Technical developments are normally expected in dull business times, and while no startling changes occurred in practice last year, still alloy makers were engaged in the usual routine development work, and mine operators put their properties and mills in condition for better days expected to come. As is known, the character of the steel casting output of the country is changing; more alloy-steel castings are being made yearly, and the electric alloy-steel output is growing. These changes portend greater consumption of ferroalloys and special steel making metals in future years. Recent developments indicate the growing importance of alloy cast iron for industrial use, and alloy cast iron received considerable attention in the past year, i. e., the manufacture of direct alloy pig iron and also the use of alloy cast iron in foundry practice. Further work has been done on the investigation of substitute deoxidizers by Cain; this was started during the war under the auspices of the National Research Council.

More attention has been paid to the preparation of low carbon ferroalloys by the refining of high carbon ones, and a number of interesting patents purporting to be suitable for this have been taken out in the past year. A new development in this direction is the production of various grades of low carbon ferromanganese by refining the high carbon alloy in the electric furnace. This is being done commercially in France and the alloys are now available in the American markets. Silicothermy was the subject of increased interest and experiment in 1921, and evidently the silicon reduction of ores will be more fully investigated and applied commercially. Much attention was given also to high chromium alloys of iron for oxidation and heat resisting uses. The use of alloy steel for bridges has received further attention in Germany, and it is not improbable that alloy steel bridges will be important in the future.

Ferromanganese and Related Alloys

Manganese mining was naturally at a low ebb in the United States in 1921 and the output was at pre-war levels. Imports of manganese ore in 1921 (principally from Brazil and British India) were about 400,000 gross tons* as against 601,437 tons in 1920, and 333,344 tons in 1919. Southern manganese operators were active in regard to consolidation of properties and planning for more efficient operation of the mines, but little ore was produced. Manganese mining in the Batesville district (Arkansas) has been practically suspended, as was the case in Montana. An outstanding occurrence was the purchase of the Morro da Mina manganese property in the State of Minas Geraes, Brazil, by the United States Steel Corporation. This move makes the corporation independent in respect to manganese ore.

The monopoly of exporting manganese ores from the Republic of Georgia (Caucasus) has been given to the Société d'Exportation de Manganèse de Tchiaturi. Report has been made on the deposits of Horseshoe Range, Peak Hill Goldfield, Western Australia. These deposits have not been worked so far, but it is estimated that 1,250,000 tons of ore of marketable grade could be secured from the top crust. Foreign ore opened the year at 40 to 45 per unit, c.i.f. Atlantic ports, went as low as 20c, and closed at 22c to 23c. There was a sagging tendencing all year, and prices were less than half those in 1920.

OUTPUT AND MARKET

The domestic output of ferromanganese in 1921 may be taken as about 93,000 gross tons, as against 282,681 tons in 1920 and 179,029 tons in 1919. The spiegeleisen production in 1921 was about 67,000 tons as against 103,448 tons in 1920 and 65,391 tons in 1919. The imports of ferromanganese in 1921 were about 9000 tons, as against 59,254 tons in 1920, and 33,022 tons in 1919. Exports were about 800 tons in 1921, as compared with 3454 tons in 1920, and 2999 tons in 1919. The production and movement of both ferromanganese and spiegeleisen have been the lowest in history. No spiegeleisen has been made since last July.

Prices for ferromanganese were exceedingly low in 1921 as compared with 1920, and much foreign and resale alloy was available. With open-hearth steel operations, particularly among the independent steel companies, at the lowest point in years, consumption was much restricted and most melters had ample supplies. Domestic 70 to 80 per cent ferromanganese was quoted at $120 to $125 per ton in January, and declined gradually to $60 to $63 at the close. English alloy correspondingly sold at $130 to $135 down to $60 to $63, c.i.f. At-

*Figures for production, imports and exports of ores and alloys in 1921 are estimates in all cases, since they are based on figures reported for only part of the year.

lantic seaboard. Spiegeleisen opened at $60 to $65 per ton for 18 to 22 per cent alloy and showed a downward tendency all year, dropping to $25 to $27, but strengthening at the close to $30 to $32.

NEW LOW CARBON ALLOYS

In connection with the development of low carbon alloys, it is of interest to direct attention to some new grades of manganese and ferromanganese produced by French makers. One contains 75 to 80 per cent Mn, 0.10 per cent maximum C, 1.5 per cent maximum Si, and 25 to 20 per cent Fe. Another contains 95 to 97 per cent Mn, 0.10 per cent maximum C, 2 per cent maximum Si, and 1.5 per cent maximum Fe.

The Kyva Ferromanganese Corporation resumed making ferromanganese and spiegeleisen in the 10-ton electric furnace at Cleveland, Tenn.

METALLURGICAL PROGRESS

In the metallurgy of ferromanganese, the greatest single advance as regards electric furnace practice has been in the use of the Söderberg continuous electrode, introduced in the United States two years ago by the late J. W. Richards. In smelting oxide ore in the electric furnace it has been found that better recoveries are obtained when any necessary iron is added in the form of manganiferous iron ore rather than as steel turnings. It is likely that with the same grade of ore the electric furnace would show at least 5 per cent greater recovery than the blast furnace, and considerable reduction of cost is possible by the use of the Söderberg electrode.

A method for preparing low-carbon ferromanganese is described in a recent patent (Canadian patent 209,740, March 22, 1921). Thaler has discussed the production of pig iron containing manganese from manganiferous blast furnace slags and other residues in the electric furnace, while Stöckmann has described the production of silicospiegel in the blast furnace. The equilibrium diagram of the carbon-manganese alloys has received further attention at the hands of Kido.

Electric and Bessemer Ferrosilicon.

Developments in ferrosilicon in 1921 were unfavorable, and several makers of 50 per cent alloy went out of business in the first few months of the year. With steel production low, and manufacturers of automobile castings out of the market, there was little demand for Bessemer grades and silvery iron. Imports of all grades of ferrosilicon were about 6300 gross tons in 1921 as compared with 13,609 tons in 1920 and 10,445 tons in 1919. Exports were about 380 tons as against 632 tons in 1920. Prices for all grades were lower than in 1920, and some extremely low prices were named by makers of electric ferrosilicon of the lower grades—the differential between these and the blast furnace product being about $14 at one time. Bessemer ferrosilicons—9, 10, 11, and 12 per cent, grades—sold at $61, $64.50, $67.80 and $71.10, respectively, until the latter part of March, then dropped substantially, and had a downward tendency most of the year. At the close, the 10, 11, 12, 13 and 14 per cent grades were quoted at $38.50, $41.80, $45.10, $49.10 and $54.10, respectively, Jackson and New Straitsville, Ohio. Domestic 12 to 15 per cent electric furnace alloy sold at $55 to $60 at the opening and closed at $38 to $40 per gross ton, f.o.b. works. The 50 per cent grade opened at $75 to $80 and declined to $57 to $60, furnace, freight allowed, while the 75 per cent alloy opened at $150 and declined to $120 to $125. Foreign and resale alloys were plentiful.

METALLURGICAL DEVELOPMENTS

Siliconthermy received more attention than in some years. Terrisse and Levy (British patent 151,974, Aug. 3, 1920) have patented the addition of tungsten and vanadium to acid-proof iron-silicon alloys for the purpose of improving the mechanical properties. Becket (United States patent 1,386,227) has a process for refining crude electric furnace silicon, based on the selective action of hydrofluoric acid on the iron contained as an impurity. Piowarsky has examined exhaustively the effect of the time of adding silicon on the physical properties and gas content of open-hearth steel and recommends adding ferrosilicon as late as possible. Lowzon has examined the constitution of the iron-silicon system and published a complete diagram. In passing, it may be pointed out hat there is a latent demand for very pure silicon for use in the manufacture of light aluminum-silicon alloys.

Ferrochromium and Stainless Steel.

The depression in the United States in mining chromite, which started at the close of the war, continued through 1921 and the industry is decidedly flat. However, pre-war conditions in chromite are being restored, with Rhodesia and New Caledonia as the leading producers. Expansion of mining operations in the Macri district, Asiatic Turkey, is planned to the extent of a production of 100,000 tons annually. The three largest mines are American owned. Chromite mining in Bosnia and Serbia will be resumed by the Jugo-Slovakian Government. The deposits of the Umwecke Hills, Rhodesia, have been examined and reported upon by the Rhodesian Geological Survey.

California concentrates, 50 per minimum, opened at 55c. to 60c. per unit and declined to 45c. to 55c. in June. Thereafter, 40 to 45 per cent foreign ore brought $20 to $25 per net ton, Atlantic ports. Prices for the various grades of domestic ferrochromium declined steadily all year from 16c. to 17c. per lb. of contained Cr for the 6 to 8 per cent C grade to 11c. and from 17c. to 18c. for the 4 to 6 per cent C grade to 11c. to 12c.

PATENTS OF THE YEAR

Several patents have been taken out for the preparation of low carbon ferrochromium. These include British patents 145,709 and 145,711, June 26, 1920; 152,990, Jan. 12, 1921; and 148,456, July 10, 1921; and United States patent 1,365,901. In one case low carbon ferrochromium is made by the interaction of the high carbon alloy, chrome ore and oxides which readily yield oxygen, in the electric furnace.

Walter (British patents 156,561 and 157,054, May 4, 1920) suggests ferrochromium-silicon alloys and a method for their manufacture. Low carbon ferrochromium is essential in the manufacture of stainless steel. Both stainless steel and stainless iron, so-called, received a great deal of attention in the past year. The production of a steel possessing acid-, heat-, and oxidation-resisting properties obviously has a great future, and apparently only the fringe of possibilities in these materials has been touched. Stainless iron (in fact a very low carbon stainless steel) has been put upon the market by three British firms. Various high chromium alloys for oxidation-resisting and other purposes have been patented recently (Canadian patents 206,785, Dec. 21, 1920, and 207,477, Jan. 11, 1921; United States patents 1,365,091, 1,375,081, 1,375,672, and 1,375,673.) Fahrenwald has suggested iron-chromium alloys for non-corrodible gun barrels, and there may be possibilities in this direction, at least for small arms. The number of such arms that become useless each year because of rusting or pitting is enormous.

Ferrotungsten.

Tungsten mining in the United States is now dormant, owing to the low prices for foreign ores and the general quietness in the ferroalloy industry. Consumption of tungsten in 1921 was very small because of the general inactivity and the slack demand for most metal products. Domestic scheelite sold at $4 to $4.50 for 60 per cent WO_3, f.o.b. mines, in January last, and the price gradually declined to $3. Foreign wolframite

brought $3 to $3.50, New York. Chinese ore was offered at $2.50. Some of the tin-tungsten mines in foreign countries were shut down on tungsten but operated on tin; for example the Kaubauk Burma Wolfram Mines, Ltd.

Hess has described the unique tungsten deposits near Oruro, Bolivia, while Brown has similarly dealt with the deposits of Burma. Bowater has described the dressing of tungsten ores at the Burma Queensland Corporation, Wolfram Camp, North Queensland. Blanch (German patent 330,987, March 28, 1920) has patented a process for treating tungsten ores, consisting briefly of decomposing with an alkali chloride, roasting and treating with sulphuric acid.

Prices of ferrotungsten and tungsten powder have been steadily on the down grade. The 70 to 80 per cent alloy sold at 55c to 60c at the beginning of the year, and closed at 40c to 45c per lb. of contained W. Prices were less than half those in 1920. Foreign alloy was offered freely. Head (Canadian patent 208,990, March 1, 1921) suggests the preparation of tungsten by heating a mixture of sodium tungstate, ammonium chloride and charcoal at 1000 to 1150 deg. C. Lohman (British patent 157,780 Jan. 10, 1921) patents a process for the removal of carbon from tungsten by heating it at approximately the melting point in an atmosphere of hydrogen. Alexander (British patent 155,739, April 6, 1920) patents the use of tungsten tablets for adding tungsten to steel. In recent years ferrosilicon (85 per cent Si) has been used considerably in England instead of aluminum powder for the reduction of tungsten and ferrotungsten.

Ferrovanadium

Ferrovanadium was in better supply in 1921 than in 1920, and although there was a slight scarcity at times the demand was less. The Vanadium Corporation of America is planning an installation for the treatment of the mine waters at Minasragra that carry an appreciable quantity of vanadium heret fore lost in Lake Punrun. The recovery from this source, it is estimated, will be $500,000 yearly. Research looking to the recovery of vanadium oxide from western phosphates, and from coal, hydrocarbon shales and natural asphalts has been suggested as a proper activity for the Government. Vanadium occurs in the ashes of some domestic coals to the amount of 38 per cent. The vanadium-bearing asphaltites hav come in for further interest. There are a number of deposits of such asphalts in the world, and it is possible that they may become sources of vanadium. A large area in the provinces of Pasco, Yauli, and Jauja, Peru, contains a series of deposits that give an average of 1 per cent, V_2O_5, and the ashes of which give an average content of 50 per cent. The old Chichi silver mine at Culiacan, Mexico, has been found to contain considerable vanadium in the form of lead vanadate.

The Course of Prices

Vanadium ore, minimum 18 per cent V_2O_5, sold at $1 to $1.50 per lb. of contained V_2O_5, while carnotite containing 1.5 per cent U_3O_8 and 5 per cent V_2O_5 brought $1.50 and 75c. per lb. for the respective oxides, the ore containing 2 per cent U_3O_8 and 5 per cent V_2O_5, sold at $2.25 and 75c. Mackay (British patent 157,555, Oct. 18, 1919) and Copelin (United States patent 1,381,802) have brought out processes for the treatment of vanadium ores.

Ferrovanadium, 30-40 per cent V, sold at $5.75-$6.75 per pound of contained V, with differentials depending upon the silicon content, during the first part of the year, but the price fell to $4.25 to $4.50. Cadenhead and Goodwin (Canadian patent 208,623, Feb. 15, 1921) have patented a process for treating vanadiferous iron ore in which the ore is furnaced with a reducing agent and a suitable flux to produce a pig iron having a maximum quantity of vanadium therein. In the suit of the Bethlehem Steel Co. vs. the Churchward International Steel Co., the Churchward patents relating to vanadium steels were held void for want of invention.

Ferromolybdenum

Molybdenum had another quiet year in 1921 but structural molybdenum steels are being taken up more and more, and the properties and possibilities of these steels are gradually being better understood. The flotation method has been adapted to treat the majority of molybdenum ores and will probably be the principal one use in the future. The Elnore oil process has been used almost exclusively in Norway, but has not found favor elsewhere. Deep molybdenum ores, containing 50 per cent Mo, have been found in New Mexico in the past year. In Canada, the molybdenum industry at Quyon, Que., is now quite dead. Molybdenite, 85 per cent MoS_2, was quoted at 55c. to 60c. per lb. of MoS_2, New York, all year. Forland (Canadian patent 207,832, Jan. 25, 1921) has a process for treating molybednum sulphide ores with chlorine gas, thereby forming molybdenum chloride which is condensed.

Molybdenum for Structural Steel

In regard to molybdenum steels, it has been pointed out by Mathews that the structural type will not wholly displace any other type of steel but that these steels have established a place among the alloy steels found useful to the aircraft, motor and general engineering trades. The structural molybdenum steels appear to have a wide safe heat treatment range as determined by static tests. Below 1 per cent, molybdenum gives no trouble from volatilization, but volatilization difficulties are bad in high-speed molybdenum steels. In the manufacture of molybdenum structural steels in the open-hearth furnace, the experiments of Schmid indicate that it is best to add ferromolybdenum in the furnace. Mathews finds that ferromolybdenum, molybdenum powder, and calcium molybdate are equally satisfactory for making fixed additions of molybdenum to steel. According to a patent (German patent 337,961, March 3, 1920), briquettes of calcium molybdate are made by mixing molybdenum trioxide and calcium chloride with water, pressing the mix into shapes and drying. The use of molybdenum, with or without copper, in iron for the production of rust-resisting alloys is patented by Charls (United States patents 1,363,564, 1,355,589, and 1,355,590). Ferromolybdenum sold at $2 to $2.50 per lb. of contained Mo in 1921.

Ferrotitanium, Ferrouranium and Ferrozirconium

The year was a quiet one in ferrotitanium, ferrouranium, and ferrozirconium. Further experiments have been made in smelting the titaniferous iron ores of Canada, while Heskett has given a résumé of experiments carried out by the New Zealand Iron Ore Smelting & Mfg. Co. on titaniferous magnetite (9 per cent. TiO_2). Sicard (United States patents 1,374,035 and 1,374,036) has patented processes for producing low-carbon ferrotitanium by smelting a high-carbon alloy with an excess of titanium oxide. The prices for ilmenite and rutile were practically stationary last year. Ilmenite, 52 pef cent, TiO_2, sold at 1.25 to 1.50c. per lb. while 95 per cent rutile brought 15c. Ferrocarbon-titanium, 15 to 18 per cent, was quoted at $200 to $225 per ton, f.o.b. Niagara Falls, N. Y.

The carnotite ore of Colorado supplies the domestic raw material for the manufacture of ferrouranium as in previous years. Polushkin, in the Carnegie Scholarship memoirs of the Iron and Steel Institute, has discussed the alloys of iron and uranium, and has made microscopic examination and tensile tests of uranium steel. The recovery of uranium is best when ferro uranium is added to the ladle in making steel. Uranium oxide, 96 per cent, brought $2.25 to $3 per lb. in 1921.

Quotations for carnotite have been given above under ferrovanadium. Ferrouranium, 35 to 40 per cent., sold at $6 to $7 per lb. of contained U.

The Bureau of Mines, by the issue of its Bulletin 186, has made available much data on the occurrence, properties and preparation of zirconium, and this publication should be of much value to alloy makers. Recently as much as 3 per cent of some of the auriferous sands of Idaho has been found to consist of zircon mixed with monazite. Schoeller has discussed the removal of titanium and other impurities from zirconia by the process based on the preparation of crystallized zirconium oxychloride. North and Loosli British patent 155,299, Dec. 15, 1920) have patented a process for reducing zirconium oxide by mixing it with the theoretical amount of carbon and heating under increased pressure in an electric furnace. Sicard (United States patent 1,374,037) has patented a process for the preparation of low-carbon ferrozirconium by decarburizing a high-carbon alloy with titanium oxide, and a process (United States patent 1,374,038) for the manufacture of zirconium steel by treating steel with a zirconium-silicon alloy. In 1921, zircon sold for 3c to 5c per lb.

Minor and Complex Ferroalloy

Much experimental work carried out recently on minor and complex ferroalloys has been reported in the patent literature. Ferroaluminum and complex ferroaluminums, e.g., ferrosilicon-aluminum, are receiving further attention, and the direct manufacture of the latter in the electric furnace from iron-bearing aluminum silicates is a commercial possibility. Penniman and White (United States patent 1,369,298) suggest ferrosilicon-aluminum, made by reducing compounds of aluminum, silicon and iron, such as feldspar, in an electric furnace with iron and carbon. Hadden (British patent 165,166, March 17, 1920) has patented an aluminum-uranium-magnesium alloy for deoxidizing steel, while Vos (Canadian patent 206,713, Dec. 21, 1920; British patent 162,917, May 5, 1920, and United States patent 1,382,147) has patented an aluminum-rich aluminum-magnesium alloy for the same purpose. Calcium silicide is now being manufactured in fairly large quantities in France for use as a steel deoxidizer, and it is growing rapidly in favor in connection with electric-furnace steel making practice. Pistor *et al.* (United States patent 1,376,113) patented a ferrosilicon-magnesium alloy for use as a deoxidizer.

The use of 4 to 5 per cent nickel in high silicon cast iron for electrical resistance grids is reported, and Bauer and Piowarsky have examined the effects of cobalt and nickel on cast iron. It appears that a content of 1 per cent nickel is desirable but that cobalt has deleterious effects. Some tests have been made at Sheffield, Eng., of one of the nickel-base (Ni-Si-Al-W-Mo-Zr) alloys, known as cooperite, for cutting tools. The Australian nickel firm, Ballande & Son, is proceeding with its proposals for the installation of electric furnaces for the manufacture of ferronickel.

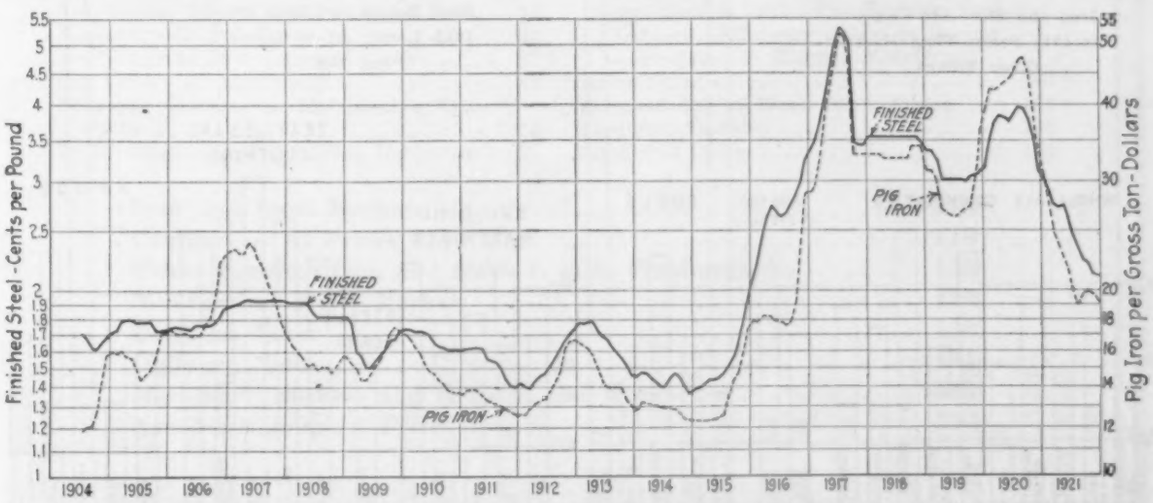
Many complex alloys for various purposes have been patented recently but these need not be reviewed here. It has been suggested that niobium be used in steel alloys, alone or with other metals, e.g., tungsten or tantalum, and alloys prepared from electrolytic carbon-free iron and containing 3 to 10 per cent Cu for resisting corrosion are also suggested.

The publication last year of the methods of the chemists of the United States Steel Corporation for the sampling and analysis of ferroalloys is of general interest.

Prices of Iron and Steel and Other Products

Analysis of Basic Facts Shows Steel Lower Than All Other Commodities Save Those from the Farm and Certain Other Metals

BECAUSE of persistent mis-statements of financial and other writers finding their way into print, THE IRON AGE published last September a diagram showing how the composite price of finished steel compared with the prices of ten groups of wholesale products, which are quoted month by month by the United States Bureau of Labor Statistics. It was shown by that diagram that, in spite of false representations to the contrary, finished steel was lower at that time than any of the Labor Bureau groups with the exception of farm products and of the metals and metal products group, including steel itself. Not only was steel much lower than the others, but it was considerably lower than the average of all. Another thing which that chart showed was that the 1920 peak of finished steel was lower than eight of the ten Labor



Course of Prices of Finished Steel and Pig Iron Since 1904, Based on THE IRON AGE Composites. Pig iron went higher in such boom years as 1906-7 and 1920 than did steel

Bureau groups, the other two being the metals group, which includes steel, and the chemicals and drugs; but it should be noted that the latter group was far higher in September than was steel.

These figures have now been brought down to date and somewhat amplified, so that the two accompanying charts show not only the relation of finished steel to the ten groups of the Labor Bureau, but also compare finished steel and pig iron with five representative items of fuels, all of which, with the exception of coke, are to-day much higher than steel. The second chart compares three groups of individually priced items with steel beams. These three groups are building materials, textiles and clothing, and foods, with five items in each group.

It will be noted that beams are to-day exactly at the same price as in 1913. Consequently, in the diagram, there is no shaded area above the 1913 level for beams. In the case of all the other items compared with beams, the present price is higher than in 1913, six of the items being still more than double their prices of eight years ago. It will also be noted that, while the price of beams in the fall of 1920 was more than double the 1913 and the present price, yet in the case of every one of the other fifteen products shown, the relative price in 1920 was considerably higher than the price of beams. One of the items was, in 1920, more than seven times its 1913 price; eight others were more than three times the 1913 price, one of these being more than four times.

In all of the items shown in the two diagrams, the 1913 average is the base of the comparison, this being considered as the "100 per cent" price. Above this base is a shaded area, representing the excess of the present price over that of 1913. Above the shaded area, again, is a white area, representing the excess of the 1920 peak price over the present price. From this it follows that the entire height of each bar represents the 1920 price, and the height to the top of the shaded area represents the present price.

It requires only a little study of the facts in the case to show conclusively that iron and steel prices to-day are lower than the prices of most of the other large items entering into the business of the United States. Only when we come into the field of non-ferrous metals, and into the field of farm products, do we find any considerable bulk of material selling lower to-day than finished steel.

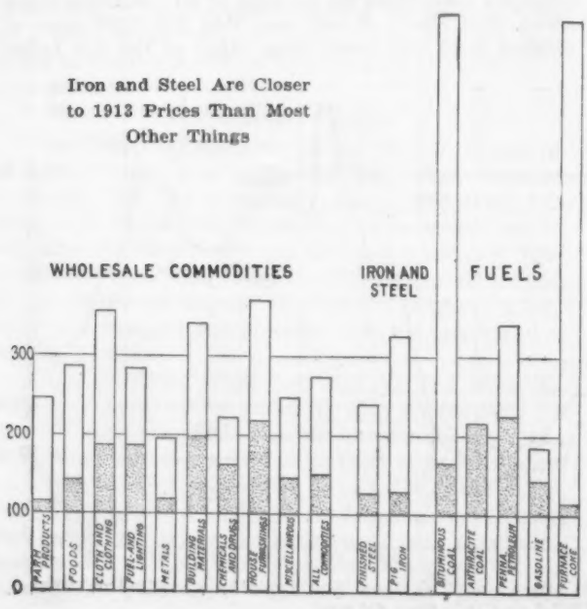
Item	Prices Quoted — Average 1913	Prices Quoted — Peak 1920	Prices Quoted — Present Figure	Index Number, 1913 = 100 — Peak 1920	Index Number, 1913 = 100 — Present Figure
Farm products	....	....	....	246	114
Food, etc.	....	....	....	287	142
Cloths and clothing	....	....	....	356	186
Fuel and lighting	....	....	....	284	186
Metals and metal products	....	....	....	195	119
Building materials	....	....	....	341	197
Chemicals and drugs	....	....	....	222	162
House-furnishing goods	....	....	....	371	218
Miscellaneous	....	....	....	247	145
All commodities	....	....	....	272	149
FINISHED STEEL	1.663c.	3.974c.	2.062c.	239	124
PIG IRON (composite)	$14.70	$47.84	$18.68	325	127
STEEL BEAMS	1.50c.	3.10c.	1.50c.	207	100
Fuels					
Bituminous coal	$1.34	$10.00	$2.20	746	164
Anthracite coal	3.82	8.00	8.25	209	216
Penna. petroleum	1.79	6.10	4.00	341	223
Gasoline	16.8c.	31c.	24c.	185	143
Furnace coke	$2.41	$17.75	$2.75	735	114
Building Materials					
Yellow pine	28.50	67.50	45.00	237	158
Red brick	6.20	19.85	14.10	320	227
Lime	4.43	11.85	9.16	268	207
Plate glass	31.8c.	82c.	70c.	258	220
Shingles, red cedar	$1.97	$6.57	$3.06	334	156
Textiles and Clothing					
Cotton	12.84c.	43.75c.	18.8c.	341	146
Sheeting	7.3c.	28.5c.	12.6c.	390	173
Raw silk	$3.65	$16.25	$7.50	445	205
Worsted suitings	1.38	5.42	2.57	392	186
Women's shoes	2.17	8.25	5.60	379	257
Foods					
Mess pork	20.93	47.00	25.00	225	119
Smoked ham	16.60	37.70	27.60	227	166
Potatoes	61.4c.	4.43	1.53	721	250
Flour	$4.61	16.25	7.50	353	163
Milk	3.5c.	8.5c.	6.9c.	243	197

The Association of Friends of the Academy of Mining at Freiberg, Saxony (Gesellschaft der Freunde der Bergakademie Freiberg), was founded on Dec. 3, 1921. The aim of this association is, in part, to help the academy in fulfilling its task as regards research work and teaching. The chairman of the association is Dr. K. Sorge, chairman of the Reichsverbandes der deutschen Industrie (Union of German Industries). The association asks alumni to become members.

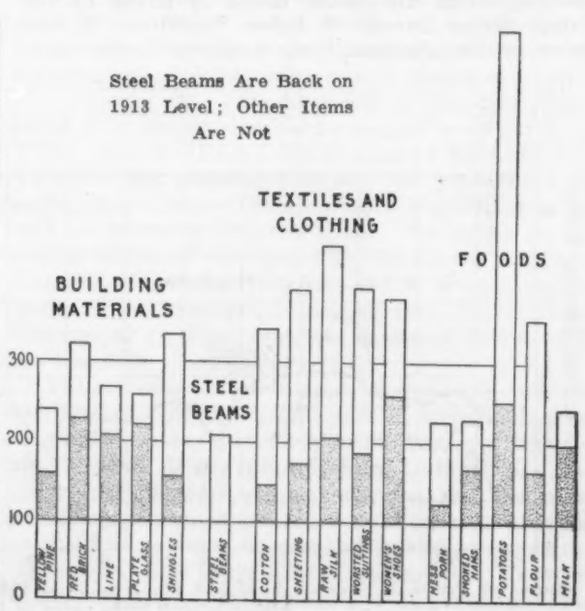
The General Electric Co., Schenectady, N. Y., has distributed a bonus among employees totaling five per cent of earnings for the past six months, ending Dec. 31, and including all workers in the service of the company for the past five years or more. The last supplementary compensation of this character was made on June 30 last, with aggregate distribution of $1,067,899 to 24,772 employees.

At the annual meeting of the Manufacturers' Association of Connecticut, held at New Haven, Dec. 29, the following officers were elected for the ensuing year: President, E. Kent Hubbard, Middletown (re-elected); vice-president, John H. Goss, Waterbury; and treasurer, Robert C. Buell, Hartford.

Iron and Steel Are Closer to 1913 Prices Than Most Other Things



Steel Beams Are Back on 1913 Level; Other Items Are Not



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ESTABLISHED 1855

THE IRON AGE

EDITORS:

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CHARLES S. BAUR, *Advertising Manager*

Member of the Audit Bureau of Circulations and of Associated Business Papers, Inc.

Published every Thursday by the IRON AGE PUBLISHING CO., 239 West 39th Street, New York

F. J. Frank, *President* PRINTED IN U. S. A. George H. Griffiths, *Secretary*

Owned by the United Publishers Corporation, 243 West 39th Street, New York. H. M. Swetland, *Pres.*, Charles G. Phillips, *Vice-Pres.* A. C. Pearson, *Treas.* F. J. Frank, *Secy.*

BRANCH OFFICES—Chicago: Otis Building. Pittsburgh: Park Building. Boston: 410 Unity Building. Philadelphia: 1420-1422 Widener Building. Cleveland: Guardian Building. Detroit: 317 West Fort St. Cincinnati: Mercantile Library Bldg. Washington: 816 Fifteenth St., N. W. San Francisco: 320 Market St. London, Eng.: 11 Haymarket, S.W. 1.

Subscription Price: United States and Possessions, Mexico, Cuba, Shanghai, $6.00; Canada, $8.50; Foreign, $12.00 per year. Single copy 50 cents.

Entered as second class matter, June 18, 1879, at the Post Office at New York, New York, under the Act of March 3, 1879

Moving Toward Prosperity

It was said in these columns one year ago that there was hope in the fact that the people of the United States were again on the road to prosperity. Looking back over 1921 one sees very little that appropriately could be linked up with the word prosperity. Yet it is even plainer to-day than it was one year ago that when in 1920 the American people began to realize that for six years they had been traveling away from prosperity, they then had taken the first step on the return road.

The war years had been years of wasteful expenditure by the Government of billions it had borrowed from the people. Then followed two years in which the spending of wealth rather than its production was the controlling purpose. The collapse in 1920 brought home the lesson that war prices, war profits and war wages were an unhealthy combination. Then began the painful process of readjustment, called also deflation. It continued throughout 1921 and promises to go on during 1922.

Apart from the war's destruction of accumulated wealth, its worst economic effect was the belief it left in the minds of many men that a new era had come in which by getting a large wage for less work the worker had reached his best estate. The past year has been showing how great a delusion that was and how the worker has been crippling his own buying power. To the extent to which the delusion has been driven out, the discipline of these months of depression has been wholesome.

One year ago, also, producers and dealers were much given to argument over high prices—argument that either repelled the charge of profiteering, or pointed out how producers or distributers in some other line were guilty of that thing and thus were delaying the return of prosperity. To-day, while the inequalities in the fall of prices and wages are well recognized, there is much serious work upon the problem of so reducing unit cost as to persuade the consumer that he can buy with safety.

The phase of the cycle has been reached in which money has become cheaper. The beginnings are seen of the next phase, in which cheap money promotes the buying of securities. And next in line is larger buying of cheapened commodities. Thus the events of 1921 have gone far toward demonstrating that while the upheavals of the war have changed many things, they have not abolished the basic laws that have governed the return of prosperity after every other crisis in finance and industry.

On other pages is traced in some detail the process of readjustment in iron and steel—the industry that is fundamental to all the country's manufacturing activities. Economies are coming into play that were impossible with the state of mind of owner and workman what it was in the years of the war and the two years following. In the metal-working industries, of which iron and steel are the raw materials, there is the same disposition to meet the requirements of the new situation by enforcing production economies. In the machine tool branch, in which the year has been especially disastrous, the effort to meet the situation is evidenced by some steps in redesigning and in a few cases by the introduction of lines of manufacture, apart from tools, not followed heretofore.

War effects have been held so largely responsible for all that has happened to industry that too often the tendency has been to drift under the influence of events. Thus fluctuating exchange, the precipitous drop in exports, Germany's default, high freights, tariff uncertainty, excessive taxes, over-capacity and undigested product have been put in high control in many cases, while individual initiative has abdicated. But more recently there have been signs of stirrings that point to renewed activity in many directions in the coming year. Progress may not be rapid and there may be interruptions, but there should be no mistaking the fact that industry is traveling the road that leads to prosperity.

Reports are that a few strong industrial establishments are planning to manufacture for stock. Such companies are fortunate in not having to

carry manufactured product into 1922. They feel that deflation in the raw materials they use has pretty nearly run its course. They are asking, however, for lowest possible prices, with the understanding that the savings effected will be offered to the potential buyer. They expect to approach purchasers who were negotiating in the latter part of 1920, and believe they have a fair chance of making sales, seeing at how much less the given machine or apparatus can now be had than the prices quoted when the collapse of 1920 came. There are plants which need additional or more efficient equipment and they have been postponing against the coming of favorable market conditions. It may be that the makers who are seeking business in the way indicated have actually an optimistic view of early 1922 and intend to be forearmed with low-priced materials and a backlog of orders. The international character of one of the concerns has made an impression on sellers, who consider these attempts to stimulate activity as of more than ordinary importance.

Readjustment in 1921

A year ago readjustment had only begun and it was patent that the readjustment process was necessary in everything. To-day it can be said that in many quarters readjustment is now completed or well advanced. The inventory of the things that have not been readjusted is much shorter than the inventory of those that have.

In steel prices the liquidation has gone far. Steel prices are approximately one-fourth higher than the average prices of 1913, while commodities in general, as shown by the Bureau of Labor's index number of wholesale prices, are approximately one-half higher. Steel prices are indeed only one-half higher than they were at the low point at the end of 1914, a price level which did not enable the Steel Corporation, with all its economies, to earn all its bond interest in the following January. With lower wages, lower freight rates, lower taxes and lower cost of general supplies the steel industry could reduce prices still further; but making allowance for these items steel is selling at the lowest price in the whole history of the industry.

Not so much can be said for the cost of consuming steel or putting it into employment as can be said for the price of steel f.o.b. mill. On an average, the various things that are made of steel cost more, in proportion to their pre-war cost, than does the steel itself. This is largely due to incomplete liquidation in labor cost of fabricating or working steel. In some cases wares made of steel are offered to the buying public at prices that make a favorable comparison with pre-war prices, but in those cases the result has been achieved by improvements and refinements in manufacturing processes.

The three great cases in which there has been a lag in the liquidating process are all cases of wages—wages on the railroads, in the building trades and in coal mining. These, disregarding influences that arise from conditions existing outside the United States, are the three conspicuous obstacles to resumption of industrial and commercial activity with pre-war vigor and confidence. The low buying power of the farmer is also an obstacle, but that is in another category, namely of over-deflation, in which it stands by itself. The expense in operating railroads that is due to wage rates above the average, and to working conditions that prevent many railroad employees from rendering full service for the wages they receive, is helping to keep freight rates up when there is a practically universal demand that they should come down.

In the building trades there has been some liquidation in wages and working conditions, but not enough. In this line of activity there has been a particularly clear illustration of the principle that some buyers can wait better than others. Construction work can be divided, very roughly, into two classes, that which is imperative and that which can wait. The home builder has been taking hold in 1921, for he has only so many years to live and is willing to bear a loss if necessary to save some of those years. The purely investment builder is not so subject to this influence and has been disposed to wait.

As to the third obstacle, the high cost of producing coal under the United Mine Workers wage scales, the termination of the present agreement on March 31 seems destined to witness a contest of no small size for the purpose of liquidating the cost of producing coal. Events of the past week indicate that the "central competitive field" is going to pieces, which means evidently that the operators will refuse to negotiate such a national agreement as they have had in the past, and instead will offer to negotiate with the miners in the respective districts; also that they will refuse to continue the check-off.

Despite the obstacles remaining, business already has found a basis on which it can expand in a moderate and conservative way. It is already on the road to improvement, and all indications are that the way will become clearer and clearer as the year 1922 grows older.

The Machine Tool Outlook

Among the numerous reviews of the past year and prophecies for 1922, a contribution of special interest and value is that of Frank A. Scott, vice-president of the Warner & Swasey Co., Cleveland, in the New York *Evening Post*. While not attempting to belittle any of the difficulties of the present situation, and while frankly stating that in September, 1920, the American machine tool industry entered upon a period of depression more severe than had ever been known, he gives his reasons for believing that it will reassert itself in the foremost position among machine tool manufacturers of the world.

Mr. Scott speaks of the extraordinary demand for machine tools which followed the armistice, to meet the needs of the automobile and other metal-working industries which were endeavoring to resume their places as producers of peacetime instead of war-time products. But by the fall of 1920 there was full realization of the seri-

ous situation which confronted the industry and "from the pinnacle of its greatest success and prosperity it descended during 1921 to the lowest level, contrasting its present productive power with the existing demand, that has been known since the making of machine tools grew large enough in volume to be called an industry."

As to the older and better established companies, Mr. Scott takes an optimistic view, saying that they have nothing to fear on account of the present discouraging period and are even now confidently predicting the outcome. Their products are well known, their organizations are seasoned and their designs represent the intelligent development of years of experience. He points out that the increased production of pig iron in foreign countries will make necessary much greater use of machine tools in order to finish the iron for use. The older companies will naturally move into the new fields of demand, but Mr. Scott does not speak with confidence of the new companies with trade names unknown, with products designed during the war pressure and unseasoned by years of experience. Many of them must go the way of other short-lived war-time industries. He says that in the new industrial era competition will again be the ruling force. Machine tools of even a few years on the market must give way to those of new design, for machine tools of even five years ago cannot compare with the new machines and the expert application of their possible service worked out by the engineering science of to-day.

In the new designing Mr. Scott believes that this country will take the lead; that it will be again a case of the "survival of the fittest," with the old and experienced manufacturers winning in the battle; that with courage and willingness to rise to the extraordinary demands of the situation success may be attained. It is clear that in the next few years the inventive genius and selling ability of machine tool manufacturers will be put to the test in an entirely unprecedented way.

Efficiency Again in Repute

Granting that most commodity prices are tending downward, it behooves an industrial establishment to limit its financial obligations to as short terms as possible. The products of manufacture some years hence will not bring as much as now, and a greater turnover will consequently be necessary then to meet maturing indebtedness. This is, of course, on the assumption that the average normal percentage of profit is secured. By the same token lending institutions will bargain not merely for good rates but for long rather than short period accommodations, seeing that the dollar paid at maturity will have increased buying power.

History shows that a deflation movement may extend for years after the sharp initial cuts from top prices. Economists believe that the story of events following the violent shaking of the world's commercial structure in 1920 and 1921 will be history repeated. Thus marked or sustained recoveries of commodity prices are not expected, and the burden of keeping the products of a plant in a strong competitive position will fall in no small part upon the purchasing department.

Prices obtained for the manufactured article will be sharply competitive as deflation continues. Profits will come more than in recent years from savings in raw material costs. Efficiency must be the watchword, not merely in manufacture, where it has always been appreciated if not practised, but also in selling as well as buying, for no longer can what is saved in the factory, a cent at a time, be thrown away in dollars in selling, a hundred cents at a time. What particularly needs emphasis now is that these times of readjustment must develop equal efficiency in every department of industry, from purchasing through to selling. In proportion as the need of that brand of efficiency gets recognition, we shall see progress toward real and lasting prosperity.

Progress in Electric Metallurgy

Two important developments mark the progress of electric furnace metallurgy in 1921. One is the larger use of the electric process for making manganese steel castings and the other the increased production of iron castings from electrically melted iron.

For years the cupola and the converter have been the melting and refining mediums for manganese steel castings. Recently the largest producer of manganese steel adopted the electric process for its entire operations and one or two new companies have been formed to make manganese steel castings electrically. An article elsewhere discusses exhaustively the metallurgy of electric practice in manganese steel castings and points out the advantages, prominent among which is the recovery of manganese steel scrap with little loss of the manganese.

The movement toward electric gray iron castings has gained momentum. Prominent in the new installations of electric furnaces last year, as recorded in our annual review, are the projects for making various gray iron products electrically. We have discussed already the metallurgy of this process and its advantages. Recognizing its importance, a large technical society will conduct a symposium on electric gray iron at its spring meeting.

In the industry as a whole, healthy progress was made last year in spite of the depression. The increase of about 9 per cent over 1920 in number of furnaces installed or contracted for was beyond expectations. While plain steel products have accounted for part of this growth, gray iron castings and manganese steel have been leading factors.

The fact that in a year of stagnant business such an industry could grow as it has holds good promise for the future. There is widespread interest in the possibilities of the electric furnace for gray iron and there will be further expansion in this field along with the normal growth of the steel phase of electric metallurgy.

MORE TROOPS CALLED

Less Disorder at Newport, Ky., and Hope of Settlement at Early Date

Governor Morrow, of Kentucky, has ordered two additional companies of national guardsmen to Newport, Ky., where they have assumed strike duty at the plant of the Newport Rolling Mill Co. There are 330 soldiers now stationed in Newport and the Governor has let it be known that the entire guard will be called out, if necessary, to maintain order. Since the arrival of the soldiers, much of the lawlessness resorted to has been stamped out, although occasionally employees of the plant are waylaid and beaten at out of the way points.

As a result of a public meeting held on Dec. 27 at the First Baptist Church in Newport, it is possible a solution of the labor difficulties now existing at the Newport Rolling Mill Co.'s plant may be found. This meeting was attended by 2000 citizens of Newport and was addressed by W. N. Andrews, president of the rolling mill company, and E. W. Miller, president of Local No. 5 of the Amalgamated Association of Iron, Steel and Tin Workers. Rev. W. B. Harvey, pastor of the church, made a proposition to both sides as a basis for settlement of their difficulties. The first clause called for recognition of the unions by the company, and other clauses stated that the union shall accept the basic rate of 28c. an hour for common labor, and that no strike shall be called for any reason within less than one month after notification shall have been given to the company that a strike is contemplated. The agreement also provides that two months' grace shall be given at the expiration of any contract between the unions and the company before a strike shall be called or the men cease to work. It is understood that a proposal from the company for the withdrawal from the Amalgamated Association of the unskilled and semi-skilled union workers will be the opening wedge in new negotiations for settlement of the difficulties.

Speaking at the meeting, Mr. Andrews stated that the loss in wages to the employees of the company since the mill closed down on July 1, last, was $4,775,000. Since January, 1919, the employees of the company had lost 53 weeks work while the company was trying to negotiate wage scales with the Amalgamated Association. Mr. Andrews also said that the company was not opposed to union principles, but found that it could not compete with other plants because of wages and other conditions imposed by the Amalgamated Association.

Mr. Miller had very little to say as to the differences between the company and the men, up to the time the break in the negotiations came. He created a stir when he declared that he believed the troubles at the mill were not caused by members of the union or by the operators, but that members of the I. W. W. were in Newport and were trying to stir up strife.

Coal Operators and Miners Will Confer

PITTSBURGH, Jan. 3.—Declination of the coal operators in southern Ohio and in the Pittsburgh district to accept the recent invitation of the officials of the United Mine Workers of America to meet and discuss a new wage scale and working conditions is not taken here to mean that the operators in either district propose to abandon all agreements with the coal miners' union and to seek to set up the "open shop" principle. On the contrary, when the miners have formulated their ideas and are ready to present them, a meeting will be held as formerly. A meeting of the United Mine Workers of America for the purpose of drawing up a new scale and a set of working conditions was scheduled for last September, but was postponed until Feb. 14, this year. The recent effort to meet with the operators was for the purpose of finding out how the operators felt and to get their ideas prior to the Feb. 14, meeting.

The operators, in declining to enter this preliminary meeting, did so because they see the possibility of a good many important developments between now and the end of the present agreement on April 1, and since this contract was made with the Government a party, there is a desire to avoid doing anything which might be opposed by the Government. Pittsburgh district operators do not believe that the new agreement should establish common scales and working conditions for central and western Pennsylvania, West Virginia, eastern and southern Ohio and Indiana and Illinois. The other districts do not compete with Illinois and Indiana and furthermore, Pennsylvania and West Virginia operators of union mines do compete with a good many non-union mines. It is probable that the new arrangement will segregate into districts what is now included in the central competitive district. It is too soon to state definitely whether the check-off system will be eliminated, but it can be said that there is a strong sentiment among operators in favor of its elimination.

Increased Use of Creosoted Wood Block Floors

The use of treated wood block floors in 1920 showed an increase of over 80 per cent over the 1919 figures, according to the Service Bureau of the American Wood Preservers' Association. Creosote oil and a creosote coal-tar paving oil were used as preservatives, with an average absorption of approximately 9 lb. per cu. ft. Incomplete statistics for 1921 show an increase over the 1920 figures and a tendency toward the absorption of a little less oil per cubic foot for interior floors. The desire for a permanent, resilient floor with high wearing qualities is given as the reason for the increased demand for floors of this type for factories, machine shops, foundries, warehouses and mills of various kinds.

Buys Wainwright Corporation

ST. LOUIS, Jan. 3.—The McQuay-Norris Mfg. Co., manufacturer of piston rings, has acquired the plant and business of the Wainwright Engineering Corporation, Connersville, Ind., manufacturer of pistons and piston pins. W. K. Norris, president of the former company, announces that the acquisition is preliminary to the entry of his company into the piston and pin business at Connersville, under the name, the McQuay-Norris Mfg. Co. of Indiana. Sales will be handled by the St. Louis company.

The General Electric Co., Lynn, Mass., is to ask all persons connected with the plant to contribute 1 per cent of their earnings, weekly, to provide a fund to relieve former and present employees from suffering and want during the winter. A relief committee of employees and officers has been formed and plant additions, repairs and yard work will be started at once to provide employment for those out of work.

The American Steel & Wire Co., Worcester, Mass., in the interest of economy, has suspended the publication of its monthly shop paper, the *Bulletin*, which contained news of interest to the 5000 employees of the three Worcester works.

THE IRON AGE AND ITS READERS

A unique contribution to the columns of THE IRON AGE appears on pages 20 and 21 of this Annual Review Number. Henry David Hubbard, the author, is secretary of the Bureau of Standards at Washington, and since 1901 has been in charge of the publications of the bureau as compiling editor. He is also the writer of the annual review of physics for the International Year Book.

In presenting his Soliloquy of Steel Mr. Hubbard has been aided by his talent as an illustrator, and most effectively we believe our readers will agree.

Railroad Buying for 1922 Undetermined

Presidents of Roads Say That Much Will Depend on Recovery in Traffic and Earnings and on Reductions in Wages

IN response to inquiries from THE IRON AGE, presidents of some of the leading railroads of the United States have indicated in statements published below what their policies are to be regarding purchases of rolling stock, shop equipment, construction of bridges, stations, shops, etc., during the coming year. With many of the roads plans are still in an undetermined stage. The extent of purchases will depend largely on recovery in traffic, which fell off in December; ability to make sufficient earnings to put into improvements, and likewise their success in reducing the high wage rates with which they were saddled under Federal control. Some of the roads which are in good financial condition have already engaged upon betterments which will come out of their 1922 budgets, but a majority of those replying have only indefinite plans in mind at this time.

By Ralph Budd

President Great Northern

Except for material absolutely necessary to maintain the railroad properties, I feel that the orders placed for iron and steel products depend very largely upon the showing of earnings made by the railroad companies. While October, 1921, was a fairly good month, November was not so good and December will show a still greater decline. This, to a large extent, is because the October earnings reflect an early movement of agricultural products.

If you will permit me to express the opinion, I would say that I think it a very doubtful policy for the heads of some of the furnace companies to pursue the course of attacking ore rates in the hearing now taking place at Chicago, by making the argument that whether the railroads can afford to reduce rates or not, they should do so to stimulate steel business. If, as you say, the prosperity of the iron and steel companies will depend to a large extent on railroad orders for 1922, I should say the iron and steel business is not being helped any by attempting to reduce rates, which will surely affect the purchasing power of the railroads adversely. It should be borne in mind that the railroads are no more prosperous than the steel companies or other industries, and that they did not make any large earnings during the war, so that while there has not been so much reduction in railroad rates since the war, the reason is that railroad rates did not reach such a high percentage above normal during the war as some other things did; and it should also be borne in mind that the average freight rate is about 65 per cent higher than it was in the decade prior to 1910, while the average price of all commodities is about 67 per cent higher than was the case during the above mentioned period.

By W. B. Storey

President Atchison, Topeka & Santa Fe

We have recently ordered 2,500 refrigerator cars which will go into our 1922 budget, the cost of these cars amounting to $8,000,000. We do not contemplate any other large equipment purchases during the year, but are likely to spend $2,000,000 additional. Our extensions of and additions and betterments to our plant may call for an additional expenditure at least as large as the average for each of the past two years, or about $10,000,000. Our budget for the coming year has not yet been presented, so that these figures indicate only in a very general way what our program is likely to be. We have no details available which would indicate how much of this is likely to be of special interest to the steel industry, nor is our budget ever worked out in such a way as to furnish this particular information separately.

By Charles Donnelly

President Northern Pacific

I have your letter, inquiring whether we have in contemplation any program involving during the year 1922 the purchase on a large scale of equipment, rails, shop machinery, etc. In reply, I have to state that we have not. Whether, as the result of the developments of the next three or four months, we may adopt a somewhat limited program of this character I cannot now say, but at present no plans are under consideration for purchases on any very considerable scale.

By W. G. Besler

President Central Railroad Co. of New Jersey

We have just placed an order with the American Locomotive Co. for 25 heavy Mikado engines. We are studying our requirements with respect to rails, ties, lumber, etc., and will determine later on the extent of our orders for this class of material. We are not prepared to do so at present.

By H. E. Byram

President Chicago, Milwaukee & St. Paul

I regret that there does not seem to be anything very encouraging in the outlook for increased purchases of iron and steel by the railroads until the general business of the country revives. Improvements on the railroads of the country practically have been at a standstill for several years and it is the improvements in equipment and facilities which require the largest proportion of steel and steel products.

The meager volume of business handled by the railroads during the past year, and which still continues, does not require any additional facilities in either the road or equipment of a railroad. In fact, the present facilities are more than adequate to handle promptly and satisfactorily all the business offered, and the high labor cost left to us as a legacy from the period of Federal control has so narrowed the spread between expenses and earnings as to leave little room for providing surplus funds which might be invested in anticipation of the return of business prosperity, which we all hope is not far away. But, until these difficulties are overcome or reconciled and the needs of the railroads for increased capacity are more pronounced than at

present, there is not likely to be an increased demand by the railways for iron and steel products.

By J. S. Pyeatt

President Gulf Coast Lines

We do not contemplate the purchase of any new equipment during the coming year. Delivery has been completed recently of new freight and passenger cars and locomotives, aggregating $3,500,000, which we believe will enable us to meet our requirements for another year. Our purchases of rail and other material and supplies we anticipate will be normal during the year 1922.

By William Sproule

President Southern Pacific

Business throughout the country is marking time waiting until prices have dropped to a fairly normal basis. This means that the pre-war state of mind is returning and purchasers are not willing to proceed on a relatively high scale of prices.

By William H. Finley

President Chicago & North Western

I believe that the buying power of the railroads is one of the big factors in business activity. It is unfortunate, however, that the financial condition of the railroads does not indicate that they will be warranted in making any large purchases at present. We are considering the matter very carefully, but cannot make any definite plans owing to the decline in our income. Like the careful mariner when in troubled waters, we are constantly on the lookout, taking soundings to determine the safety of our position and will be prepared to place orders as soon as we are assured that the ebbtide has turned.

By J. L. Lancaster

Receiver Texas & Pacific

Under existing conditions it will not be possible for the Texas & Pacific Railway to make extensive purchases of additional locomotives, cars, rails and tools for repair shops, or undertake to any great extent construction of bridges, shop buildings and railroad stations.

By Carl R. Gray

President Union Pacific System

Our budget has not yet been finished for 1922, and will not be definitely acted upon for 60 or 90 days. I anticipate that in this section, at least, the railroad business will be quiet and on something like our present levels until spring, when I hope for an improvement.

By S. M. Felton

President Chicago Great Western

I do not believe there will be any extensive buying by the railroads during the coming year. Much depends on business conditions. Railroad traffic has been falling off very sharply during the last few weeks and unless there is some decided improvement there certainly will be very little buying, beyond that which is necessary for maintenance and renewals. In the first place, we have a demand from all sides for a reduction in our rates; in order to meet this we are trying to get our wages down, but so far have not accomplished what is necessary. It is certain that unless railroad operating expenses can be materially reduced and traffic improves, there will not be any money for the purchase of additional locomotives, cars, etc. There will be, as is always the case, some scattered purchases by lines that are financially strong, but a great number of the roads are not in a position to make any large investments and many of them are still waiting for a settlement of their claims against the Government for under-maintenance during the period of Federal control. If reasonable sums should be paid out by the Railroad Administration in settlement of these claims the money would undoubtedly be invested in repairs and renewals of equipment and in rehabilitation work generally, and to that extent would be helpful. I am sorry I cannot give you a more favorable report of the situation.

By Percy R. Todd

President Bangor & Aroostook

During the past year this company purchased six heavy Consolidation freight locomotives, 30 Hart ballast cars, and a new 120-ton wrecking derrick, and in October ordered 200 steel underframe box cars, which have not yet been built; this will about exhaust our financial ability in the way of ordering new equipment, therefore we have no extensive program in this direction for next year.

By J. H. Hustis

President Boston & Maine

We have no plans for the coming year for any important permanent construction of bridges, line extensions, shop buildings or stations. We shall probably order certain equipment, but the order will not be large and final decision has not been made in the matter, so that I am unable to make any announcement at this time. As to the railroad outlook for 1922, I can only say that I believe it will continue to be a period of readjustment.

By W. L. Mapother

President Louisville & Nashville

The Louisville & Nashville Railroad Co. has certain extensive plans for addition and betterment expenditures, including equipment, but the existing business and financial conditions serve to preclude the possibility of any immediate or early decision and announcement.

[Since the above was written the Louisville & Nashville has come into the market for 50,000 tons of rails, which will be rolled at the Alabama mill.—EDITOR.]

By F. D. Underwood

President Erie Railroad

The purchasing power of railroads is not being developed as fast as we could hope. Personally I see but small hope of an increase in business until the prospects of another crop in the United States are assured. There is at present a great surplus of equipment, which fact will minimize orders for next year.

By William A. Winburn

President Central of Georgia

You ask our program for additional cars, rails, etc., and our plans for permanent construction requiring iron and steel. The latter has been provided for. It

is our purpose to purchase during the coming year about 4000 tons of steel and five hundred box cars.

By J. J. Bernet
President Nickel Plate

Our company has not outlined any program or budget for buying in the year 1922. While we have been going along in a normal sort of way, we have not made any plans for anything unusual during the coming year.

By M. M. Bremner
President, Minneapolis & St. Louis

To my mind it is very difficult to forecast what may be expected from the railroads in the year 1922 with respect to purchases of locomotives and cars and in the way of permanent construction.

Undoubtedly, there is a great need for more equipment and much maintenance of roadway and existing equipment has been deferred during the past year and temporary expedients have been resorted to because of lack of funds to do things in a proper way.

To my mind what the railroads will do in the way of purchases will depend entirely on the business outlook. But very few railroads are in a position at the present time to borrow money on terms that are at all favorable, and the result is they must depend upon their revenues until such time as their credit is reestablished. Just at the present time we are passing through a very severe slump in business with a very serious impairment of revenues. Whether this slump is temporary in character or will continue for some time to come, it is impossible at the present time to determine. My own view is that it will continue for from sixty to ninety days.

Dependent as the railroads are upon their earnings, there is little encouragement for them to extend their purchases, confronted as they are with increasingly insistent demands for reductions in rates, regardless of their ability from a revenue standpoint to stand the reductions. Already the Interstate Commerce Commission has ordered a reduction in the rates on grain and grain products, which will mean a very serious impairment of the revenues of the Western carriers and this may be but a forerunner of further reductions.

I believe that if the agitation with respect to decreased rates could be stopped and no encouragement from official sources be given thereto, there would soon be a decided improvement in general business conditions. The fact is that in nearly all lines of industry, at the present time, shippers and consignees are holding back, believing that rates will be reduced and that by holding off they will make an additional profit for themselves by the amount of the reduction, whatever it may be. If no hope of a reduction was before them, they would probably adjust their business affairs to the present level of rates and business would go on as usual.

Constant agitation with respect to a matter such as freight rates, which enter into practically every transaction of life, cannot be otherwise than harmful. What the business world needs is stability and this cannot be brought about if this agitation is to go on.

Will Sell Flat Cars

WASHINGTON, Jan. 3.—The Emergency Fleet Corporation will receive bids up to Jan. 12, at its offices in Washington, for 309 standard gage flat cars, ranging from 25 to 40 tons in capacity; 15 box cars with a capacity of 30 tons each; 35 gondolas with capacities ranging from 20 to 40 tons; and 7 locomotives. This equipment is located at Briston and Hog Island, Pa., and is offered for sale "as is where is."

THE HARDWOOD DECISION

Co-operation Somewhat Disturbed by Action of the Supreme Court

WASHINGTON, Jan. 3.—The majority opinion of the Supreme Court in the hardwood case has had the anticipated result of somewhat disturbing co-operation between trade associations and the Department of Commerce. One association has given notice that it will not submit further statistical data to the Department of Commerce for use in the Monthly Survey of Current Business, issued under the direction of the Bureau of the Census. Other associations have denoted that they are uncertain as to whether they will co-operate further, being apprehensive of the effect of the decision of the Supreme Court. The chief difficulty disturbing this co-operation, which has been carefully urged and built up upon the initiative of Secretary of Commerce Hoover, has been the doubt left as to the actual effect of the decision.

It is evident that careful analysis of the opinion has left the general impression that it affects the activities of only a small portion of trade associations of the country, but many associations which feel that they are not affected, are at the same time, left in a state of doubt pending the clear interpretation of the decision by the Government. For this reason, it is believed that some of them, at least, will hesitate to co-operate with the Department of Commerce until Attorney General Daugherty presents an official statement expressing his views in the matter. As has been previously stated, however, apparently even this will not satisfy representatives of some associations, who think that the only remedy assuring their legality lies in the enactment of legislation, though passage of such legislation, if undertaken, probably would require a long time.

Secretary Hoover's View

Secretary Hoover has reiterated his view that the decision will have a bearing on only a small number of trade associations, estimating that it will not involve over 10 per cent of the total. This calculation is based on the survey made sometime ago by the Department of Commerce as to the activities of the 1700 or 1800 trade associations of the country.

Nathan B. Williams, Associate Counsel of the National Association of Manufacturers, takes the same view that Mr. Hoover expressed and thinks that trade associations should continue their legitimate statistical activities and supply data to the Department of Commerce for public use. In an interview with THE IRON AGE Mr. Williams said:

"As a result of the Supreme Court decision in the hardwood case, some apprehension has become manifest as to the legality of the activities of trade associations who have been supplying current statistical information to the Department of Commerce, for use in its Monthly Survey of Current Business.

"This anxiety appears to be the result of the popular impression as to just what practices were condemned by the Supreme Court of the United States in the case of the American Hardwood Manufacturers' Association, decided Dec. 19, 1921.

"Early in August of this year Secretary Hoover issued a statement with respect to trade associations and their work, wherein he said:

> For some weeks the department has been making a careful study of the purposes and activities of trade associations. We find that the vast majority of such associated activity is a constructive contribution to national welfare.
>
> The department wishes to co-operate with such associations as wish it in the collection of information as to production, stocks of raw and other materials, percentage of industry in active operation, total orders, and other accomplished facts of interest to them and in the making of the information available to the whole public.
>
> The making of such information currently public acts alike to protect legitimate business enterprise and the public interest.

Selling American Machine Tools in Europe

Difficulties Encountered in all Countries Due to Disparity in Exchange and to German Competition, Which May Correct Itself

BY E. M. HARTRIDGE*

WHEN the armistice was signed, opinion was very much divided as to the future of the machine-tool markets in Europe. The same is true to-day with the future as clouded and uncertain as it was three years ago. It is becoming more and more difficult to sell American tools in Europe and unless the American manufacturers awake to this fact and take energetic measures they will gradually lose all the prestige and business that has taken years to build up.

In France, just after the armistice, there was considerable buying due to the conversion of munition factories into peace-time productivities. Also, there were the destroyed plants in the north of France on which rebuilding work was commenced almost immediately. The pre-war factories naturally returned to the manufacture of articles they were engaged in before the war, but with the added feature that their productive capacity as a whole was greatly increased. Many new factories had also sprung up during the war and they all had extensive plans for the future. Everybody wanted to keep his factory running at full war-time production and there was a feverish rush to get started on new programs and to get ahead of the other fellow.

For a time things looked rosy and there was a brisk demand for American tools, as the surplus machines and the war stocks of the United States Government had not yet begun to be thrown on the market, nor had the German competition commenced. Soon, though, things began to happen. The bottom commenced to drop out of the French as well as other European exchanges. There was a scarcity of coal and raw materials, and labor began making impossible demands. The worst, though, was when the factories were ready to produce and it was found that there were not sufficient markets to keep them busy. It was impossible to develop markets quickly enough to keep the greatly increased productive capacity of these pre-war factories going and at the same time to absorb the output of all the numerous new factories which had sprung up during the war. The automobile business in particular was greatly overdone. The result was that something was bound to happen and it did. There was a general slump followed by failures and shutting down of factories. The older and more firmly established industries have, as a rule, weathered the storm, but even with them it has been a severe struggle. All this has had the effect of automatically eliminating the surplus production in France and has sent many laborers and mechanics back to the farms where they are badly needed.

Little Buying of American Tools

The reaction will undoubtedly be a healthy one with a gradual industrial growth of France in keeping with the present market demands and those that might be developed. At the present time, there is very little buying of American tools. With francs at 14 to 15 to the dollar, it takes courage even to quote prices on American tools. The smaller and provincial concerns do not know anything about exchange and they look upon American manufacturers—and the dealers who sell American tools—as being profiteers and robbers on account of prices being so high when translated into depreciated currency values. It is not an unusual occurrence for salesmen to be actually abused and insulted when quoting on American tools. Of course, the larger manufacturers are more familiar with the exchange problem and are more lenient in their criticisms, but even they say frankly that they will not buy American tools at the present prices if they can possibly help it. The result is that American machines are only bought when it is impossible to buy elsewhere.

German competition—if it can be called such at the prices at which they are selling—is becoming steadily more and more demoralizing and French manufacturers are turning to Germany to supply their demands. This particularly as the French Government encourages buying in Germany on account of the favorable exchange and also as, through the Wiesbaden agreement, it has undertaken to receive payment of reparations in commodities instead of money.

There is still considerable demand for machine tools in the north of France in re-establishing destroyed factories, but such buying is largely financed by the French Government with the result that Germany is getting the greater part of this business and only rarely is an order secured for an American tool. For the first half of the year 1921 it is reported that France bought machines in Germany to the amount of 306,500,000 francs, which figures are indeed formidable, particularly when it is considered that from the latest available figures only about 20 per cent of the concerns operating in the North in 1914 are completely restored. There are other concerns partially restored, so that it might be said that the industries in the North are on the whole about 50 per cent restored. From the present indications it looks as if the Germans will get the remainder of this business unless the American manufacturers awake to the seriousness of the situation.

Buying in Germany to Rehabilitate Plants

During a recent visit to the north of France, I had the opportunity to visit and discuss the situation with the managing director of one of the largest and oldest works in that section, whose opinion is highly respected throughout the metal working industry. Before the war and until recently, this concern had largely favored American tools but lately had begun buying in Germany. When asked about this, the managing director explained that they simply could not continue paying such high prices for American tools when the same tools could be bought in Germany for less than half the price. The result is that they, as well as others, have recently been buying very heavily in Germany such machines as vertical turret lathes and boring mills, radial drills, planers, etc. Many of these machines have arrived and are now working and giving satisfaction. A 5½-ft. radial drill was pointed out which cost only 22,000 francs, whereas the price of a similar best make of American tool would be around 60,000 francs to-day. A 42-in. German vertical turret lathe costs 50,000 francs, while the prices on the best American tools of the same capacity range from 113,000 to 150,000 francs. One of the best German makers of grinders quotes 10,000 francs delivered France for a 12 x 36-in. machine while prices quoted on the best American tools vary with different makes from 30,000 to 45,000 francs. These are only a few examples, and in consequence everybody in the North—as well as elsewhere in France—is buying from Germany.

The dealer who confines his efforts solely to the sale of American tools is helpless to do much in the face of this situation except to continue making extra efforts and using all the strategy at his command, which may be occasionally rewarded by a small order

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when a tool cannot be obtained quickly enough from Germany or because it is not considered worth while going to Germany for a single machine. The dealer can talk quality until he is out of breath but to-day prices are invariably the final deciding factor. Even if in desperation the dealer quotes below actual cost—as is frequently the case nowadays in his efforts to get orders—his prices are still far above the German prices. It is sometimes possible to obtain an order in competition with the Germans if the difference in price is only about 25 per cent, but when the difference is so great as it is to-day, it is practically impossible to compete. There is not only the German competition in France at the present time but there is also a large quantity of surplus American tools which has been thrown on the market, and is being sold at ridiculously low prices. Until these surplus machines are finally absorbed, this kind of competition will be continually encountered.

Belgian Market Also Depressed

The same general remarks as the above hold true for Belgium, Italy, Spain and Switzerland with slight variations. Belgium had hardly got started manufacturing when the slump came and as she did not have the momentum to carry her along, the depression has been felt more in Belgium than it has in France. Also, on account of the large Army stocks of American tools dumped in Belgium by the United States Government, there has been comparatively very little buying outside of this source. Moreover, the German competition is felt very keenly in Belgium, and it was felt in Belgium sooner than in France.

Italy has gone through practically the same stages as France has—although, of course, on a smaller scale—with the added features of having had serious labor troubles. Everybody is familiar with the way the Communists took possession of the factories and only turned them back to the owners after having failed to operate them successfully. That this has demoralized the country to a large extent is shown in the general lack of confidence of capital to invest in industrial enterprises as long as the socialistic laboring element dominates the situation as it has in the past, and as it still does to a large extent. As a result, recovery is slow and many of the larger manufacturing industries are still entirely shut down. Italy is also handicapped by having to buy practically all of her raw materials and coal which cost dearly on account of transportation and the depreciated value of the lira. The German competition is also particularly keen in Italy—even more so than in France—as the bars have been entirely let down to German goods which are beginning to flood the country. However, Italy is making strenuous efforts to recover.

Spain Not Strong Industrially

As for Spain, there is not much to say. The present depression has hit this country as well as other parts of the world. The future of the manufacturing industries in Spain is very uncertain and is on an unstable basis, and it is a question whether they will be able to compete with surrounding countries such as England, France and Germany. Spain was not a manufacturing country before the war and it was only the war that gave her a start in this direction. There is very little machine tool buying being done in Spain and what there is is mostly for the cheapest kind of tools of Spanish, German and other makes. The Germans are very active in Spain and have dumped large quantities of cheap machine tools on the market which sell at very low prices. This makes it very difficult to compete with American tools.

Switzerland has probably been hit harder than France, Spain, Belgium or Italy. Before the war Switzerland sold her products largely in the surrounding countries, but now that the exchange of these surrounding countries is so greatly depreciated, they cannot afford to buy in Switzerland, which has been simply flooded with German goods, including machine tools and small tools. There is probably more unemployment in Switzerland in proportion to its size than in France, Belgium or Italy. This means that there is practically no demand for American machine tools in Switzerland and probably will not be until the factories in Switzerland are busy again.

Situation May Mend Itself

As for the German competition, it is true that this is very serious, but the situation is not as bad as might appear on the surface. As the economists point out, the Germans cannot do all the work of the world now any more than they could before the war, as their capacity is no greater now than it was then. They were very busy and effective in competition before the war and yet the rest of the world found enough to do. They are no more formidable in industrial ability and equipment now than they were then. The so-called advantages of the Germans on account of the depreciation of the mark—which has upset all relative values—is causing the German authorities and financiers the greatest anxiety.

In terms of paper marks, many salaries in Germany are still only four to six times higher than the peacetime level, although wages generally have risen to 15 times that amount. But at the same time the ratio of paper money values to gold is about 70. This will probably result in a tremendous conflict between labor and capital on the wage question during the winter and spring. The German Government, which derives a great part of its revenue from taxes on German production, is also hard hit because it is unable to collect an amount commensurate with the decline in values. The German financial structure is in serious danger of collapsing if strenuous measures are not taken to readjust relative values, and the result will be that prices will have to be greatly increased. The Germans are also under serious handicap from the requirements that 26 per cent of the value of all of their exports must be paid into the reparation fund. The tendency of this, of course, will be to pass this on to the purchaser. Germany is gradually waking up to the fact that she cannot replace the tools and other goods at the prices at which she is now selling. It has just been announced that export restrictions are being placed to prevent the wholesale shipment of goods out of the country which is now going on, and to preserve stocks of raw materials. There are also rumors of establishing a special currency—based on the value of a gold mark—for purchases intended for export in order to avoid a general increase of prices on goods intended for internal consumption as now threatened. Therefore the future is not as bad as it may appear now. It is the next six months or a year that will be the critical period and it will largely depend on the American manufacturers whether they will hold the European markets or lose them to the Germans.

American Manufacturers Must Wake Up

From the above it can be seen that the situation in Europe to-day which confronts the American manufacturers, as well as the dealers who sell exclusively American tools, is very serious indeed. The selling organizations which American manufacturers are depending on for their foreign business are real pioneers and must be good merchants as well as good salesmen and engineers. Even in face of the serious German competition they must continue to carry large stocks and finance shipments, as well as take all the risks of fluctuating exchanges, bad credits, and all the other evils which make it more difficult to do business in Europe to-day than ever before, or probably than it ever will be again. Without proper support it takes courage for a dealer to stay loyal to the American manufacturer and to continue to sell American tools exclusively, in the face of the present difficulties. In fact, many dealers following the course of least resistence, have turned to selling German machine tools. The American manufacturers should appreciate the courage and sacrifices of the dealers who remain loyal and in turn should assist them in every way. Not only should they give them the lowest prices possible, but they should look upon their foreign agents as a part of their own selling organization, giving them the same facilities as to their own organization.

Manganese Steel Made in Electric Furnace

(*Continued from page* 8)

By means of baffles and flues this flame is so controlled that it follows the roof of the furnace, and the charge is heated by radiation. This ability to prevent the flame from impinging on the castings is very important. As manganese steel can not be cut with a tool all finishing must be done by means of grinding wheels. If the flame were to strike the castings some would be heated much hotter than others, and the scaling would seriously affect the dimensions of the finished work. A small variance is allowed for this and is taken care of by the pattern maker. Unequal heats would cause great trouble after the quenching operation, resulting in warped and twisted castings, and might even cause rejections, due to tearing and checking caused by the unequal contraction.

The castings are loaded on the cars in a regular and even manner, castings of as nearly the same size as possible making up the charge. These are brought up gradually to 1800 deg. Fahr. and are allowed to soak until heated evenly clear through. The car is then pulled and the charge quenched in water as quickly as is possible. Large tanks are used for this purpose, so arranged that a constant circulation of cold water is obtained. When the charge is cold they are withdrawn and finished ready for shipment, after being inspected and straightened where necessary.

This is one of the peculiarities of manganese steel. All other steels when quenched in this manner would become glass hard. Manganese steel becomes slightly softer in Brinell number, and changes from a brittle metal to one of abnormal toughness, having a merit number (tensile strength × elongation) of about 7,000,000. As a means of regulating the heat in the furnace Segar cones are used. While these are not as efficient as a good system of recording pyrometers, they give good results.

Physical and Chemical Testing

At about the middle of the pour several different sets of test bars are made.

Breaking test.—A bar 18 in. long, and 3 in. square is cast and used for the breaking test. This bar is treated and placed on sharp supports 16 in. apart. A heavy weight is then dropped on this bar, which must stand a definite amount of blows to meet the specification. The test used is to drop a ball, weighing 4000 lb., eight times from a 6-ft. height, making an equivalent of 192,000 foot pounds.

Pulling or strength test.—A bar is cast large enough to make a standard section pulling bar when ground down to size. This is then pulled in a similar manner to carbon steel on any class of testing machine. Manganese steel has a peculiar property here. Under the pull it begins to stretch at one point. Then instead of continuing its stretch there, it begins at another point. As soon as the elongation is constant over the whole section undergoing the test, it continues this operation until ruptured. This results in a rather low elastic limit as compared to the great strength and elongation. Tests from manganese steel have shown as high as 150,000 lb. per sq. in., with an elongation of over 50 per cent. Manganese steel, when forged or worked in any manner, shows vast improvement over the ordinary cast tests. Cold working raises its tensile strength and elastic limit but lowers its elongation. Tests of cold worked material have shown as high as 250,000 lb. per sq. in. tensile strength, with an elastic limit of 230,000 lb. per sq. in.

Bending test.—This is the most important test given and is made on every heat. Several bars are cast on end; one for the chemical analysis; one to be treated in the laboratory and bent; and one for each load of castings from the heat when treated. These bars are 12 in. long, ½ in. thick and ¾ in. wide. One of the bars is taken to the laboratory and brought up to 1800 deg. Fahr. in a small electric oven. It is then quenched in water and bent until it breaks. This shows the character of the steel from the heat. The same operation is performed on the bars which go through the regular process with the castings. These are then compared and serve as a check on the treating operation. Large numbers of these bars will bend flat on themselves without any sign of checking. All bendings are made on the cold stock. From several hundred tests over a period of two years, on electric furnace manganese steel, it was found that the best bends were those where the manganese ran from 12 to 13 per cent. Regardless of the carbon, silicon, or phosphorous contents on these heats, the test bar always bent flat on itself without any visible checking on the outside of the bend. This is a pretty rigid test to meet with a steel having over 100,000 lb. per sq. in. tensile strength.

Sampling

High speed steel bars ⅝ in. round and about 3 in. long are forged down to the shape shown at A, as shown in an illustration. These are then given a rough grinding to the shape B. The semi-finished drill is then heated slowly in a forge fire to a dull red, or about 1500 deg. Fahr., and then heated rapidly to a white heat. The temperature is then about 2300 deg. Fahr. and the end of the tool is just beginning to drip and looks greasy. The tool is then suddenly quenched, point down, in kerosene for three seconds and then quenched to a black in water. The tool is ground lightly on a wet wheel and is then ready to drill.

A very heavy drill press is used where high leverage can be obtained and the sample is drilled from one of the bending test bars cast on the heat desired.

The drillings are then screened to remove any fine particles of dirt and looked over carefully for any small chips which may have fallen from the drill, and are taken to the laboratory for analysis.

Influence for Consolidation

Youngstown, Ohio, Jan. 3.—Prospect of continued operating losses for some time to come with leading independent steel makers is expected to exert a strong influence toward consolidation. Assembling of valuation data on plant, coal and ore holdings is now under way, and when completed will furnish the basis for more definite discussion as to merger terms. Losses encountered in 1921 by independent interests have served to stimulate the movement for an amalgamation, with the benefits of reduced costs of operation, shipping advantages and sizable overhead reduction.

In a message to its employees, a leading independent producer in the Mahoning Valley points out that "not a steel company in the United States made any money in 1921. On the other hand, many of them lost vast amounts. The balance sheets of many large companies will show an actual loss of millions of dollars. Only the fact that all had enjoyed prosperity for several years prevented absolute bankruptcy in many cases.

"The year 1921 was not a pleasant one for workers in the steel industry nor for most of those who work and conduct business of one kind or another in this country. It was one of the worst years from an industrial standpoint that the industry has ever known.

"The scarcity of work and the great reduction in earnings seemed even worse than they were when compared with conditions for several years past, and it required a good deal of philosophy to accept them without complaint. Nevertheless, we can find some comfort in the fact that these conditions were general and everybody had to suffer from them in about the same degree. Where wages were not reduced, there was little work, and where people did not have to labor, but depended on dividends, they suffered even more than the man whose capital is his labor."

LARGE GAIN IN IRON OUTPUT

Six Furnaces Blown In, One Blown Out

December Production 6013 Tons Per Day Larger Than That of November

Despite the temporary banking of several furnaces, usual over the holiday period, the upward swing in the pig iron output of the country continued its momentum in December. The gain per day last month was over 6000 tons as contrasted with 6968 tons per day in November over October and with 7465 tons per day in October over September. The December total is only about 400,000 tons under the February output and is the third largest month in the year.

The production of coke and anthracite furnaces for the 31 days in December amounted to 1,649,086 gross tons, or 53,196 tons per day, as compared with 1,415,481 tons or 47,183 tons per day for the 30 days in November according to data collected largely by telegraph. The increase in December over November was 233,605 tons, or 6013 tons per day.

The total number of furnaces in blast on Jan. 1 is 125 as compared with 120 on Dec. 1, with 96 on Nov. 1, with 82 on Oct. 1, with 70 on Sept. 1, and with 69 on Aug. 1, the low point for the year. In December six furnaces were blown in and one blown out.

A computation of the capacity in blast Jan. 1 is difficult because of the telegraphic and other methods of obtaining the data, due to the holidays and the temporary banking of furnaces. The December output of manganese-iron alloys was 3953 tons, one furnace having been blown in on this product during the month. Of this total 50 tons was spiegeleisen.

Daily Rate of Production

The daily rate of production of coke and anthracite pig iron by months, from December, 1920, is as follows:

Daily Rate of Pig Iron Production by Months—Gross Tons

1920	Steel Works	Merchant	Total
December	66,037	20,185	87,222
January, 1921	62,327	15,618	77,945
February	58,060	11,127	69,187
March	42,691	8,777	51,468
April	33,854	5,914	39,768
May	33,054	6,340	39,394
June	29,444	6,050	35,494
July	23,086	4,803	27,889
August	26,037	4,743	30,780
September	27,189	5,661	32,850
October	33,365	6,850	40,215
November	37,960	9,223	47,183
December	41,173	12,023	53,196

The figures for daily average production, beginning with January, 1915, are as follows:

Daily Average Production of Coke and Anthracite Pig Iron in the United States by Months Since Jan. 1, 1915—Gross Tons

	1915	1916	1917	1918	1919	1920	1921
Jan.	51,659	102,746	101,643	77,799	106,525	97,264	77,945
Feb.	59,813	106,456	94,473	82,835	105,006	102,720	69,187
Mar.	66,575	107,667	104,882	103,648	99,685	108,900	51,468
Apr.	70,550	107,592	111,165	109,607	82,607	91,327	39,768
May	73,015	108,422	110,238	111,175	68,002	96,312	39,394
June	79,361	107,053	109,002	110,793	70,495	101,451	35,494
July	82,691	104,017	107,820	110,354	78,340	98,931	27,889
Aug.	89,666	103,346	104,772	109,341	88,496	101,529	30,780
Sept.	95,085	106,745	104,465	113,942	82,932	104,310	32,850
Oct.	100,822	113,189	106,550	112,482	60,115	106,212	40,215
Nov.	101,244	110,394	106,859	111,802	79,745	97,830	47,183
Dec.	103,333	102,537	92,997	110,762	84,944	87,222	53,196

The furnaces blown in during December include the following: Brooke furnace in the Schuylkill Valley; Sheridan furnace in the Lebanon Valley; B Federal furnace in Illinois; one furnace of the Colorado Fuel & Iron Co. in Colorado, No. 2 Hattie Ensley furnace of the Sloss-Sheffield Steel & Iron Co. in Alabama, and the furnace of the St. Louis Coke & Chemical Co. in Illinois. Three of these furnaces were blown in after Dec. 23; the other three were blown in Dec. 5, Dec. 12 and Dec. 19, respectively.

Only one furnace was blown out during December, one of the Johnstown furnaces of the Cambria Steel Co. in western Pennsylvania. Several furnaces were banked over the holidays.

Production of Steel Companies—Gross Tons

Returns from all furnaces of the United States Steel Corporation and the various independent steel companies, as well as from merchant furnaces producing ferromanganese and spiegeleisen, show the following totals of steel making iron, month by month, together with ferromanganese and spiegeleisen. These last, while stated separately, are also included in the columns of "total production."

Production of Steel Companies—Gross Tons

	Total Production			Spiegeleisen and Ferromanganese		
	1919	1920	1921	1919	1920	1921
Jan.	2,430,022	2,232,455	1,932,159	32,787	23,957	22,228
Feb.	2,209,470	2,181,679	1,625,695	28,105	28,038	29,013
Mar.	2,277,507	2,480,668	1,323,443	26,644	35,275	41,294
Apr.	1,838,677	1,968,542	1,015,621	17,308	27,628	24,310
May	1,586,805	1,128,720	1,024,678	14,604	33,407	9,232
June	1,655,944	2,209,770	883,312	14,254	34,751	4,536
July	1,966,604	2,230,567	715,664	14,805	36,789	5,524
Aug.	2,108,566	2,254,943	807,144	17,419	36,985	3,878
Sept.	1,828,613	2,247,250	815,692	20,631	39,546	3,289
Oct.	1,295,690	2,393,644	1,034,312	20,238	34,786	3,902
Nov.	1,727,656	2,150,075	1,138,789	19,964	26,944	3,525
Dec.	1,916,249	2,047,167	1,276,381	15,718	28,023	3,953

Output by Districts

The accompanying table gives the production of all coke and anthracite furnaces for December, and the three months preceding:

Pig Iron Production by Districts, Gross Tons

	December (31 days)	November (30 days)	October (31 days)	September (30 days)
New York	126,734	91,535	65,502	50,970
New Jersey	5,026	4,525	4,745	4,370
Lehigh Valley	31,388	30,020	27,614	27,566
Schuykill Valley	41,450	35,850	28,176	23,126
Lower Susquehanna and Lebanon Valleys	26,106	19,356	20,581	21,903
Pittsburgh district	390,908	357,851	295,741	250,128
Shenango Valley	52,793	50,555	35,430	8,649
Western Penna.	56,593	67,432	61,742	60,073
Maryland, Virginia and Kentucky	18,917	14,754	15,827	16,046
Wheeling district	72,660	44,966	36,520	18,706
Mahoning Valley	188,391	165,562	157,512	125,705
Central and Northern Ohio	167,307	156,767	140,914	110,327
Southern Ohio	15,534	13,893	14,485	8,200
Illinois and Indiana	299,186	252,566	229,009	171,380
Mich., Minn., Mo., Wis., Colo. and Wash.	37,149	20,059	11,940	14,641
Alabama	117,886	108,125	99,948	73,739
Tennessee	1,064	1,665	990	none
Total	1,640,997	1,415,481	1,246,676	985,529

Diagram of Pig Iron Production and Prices

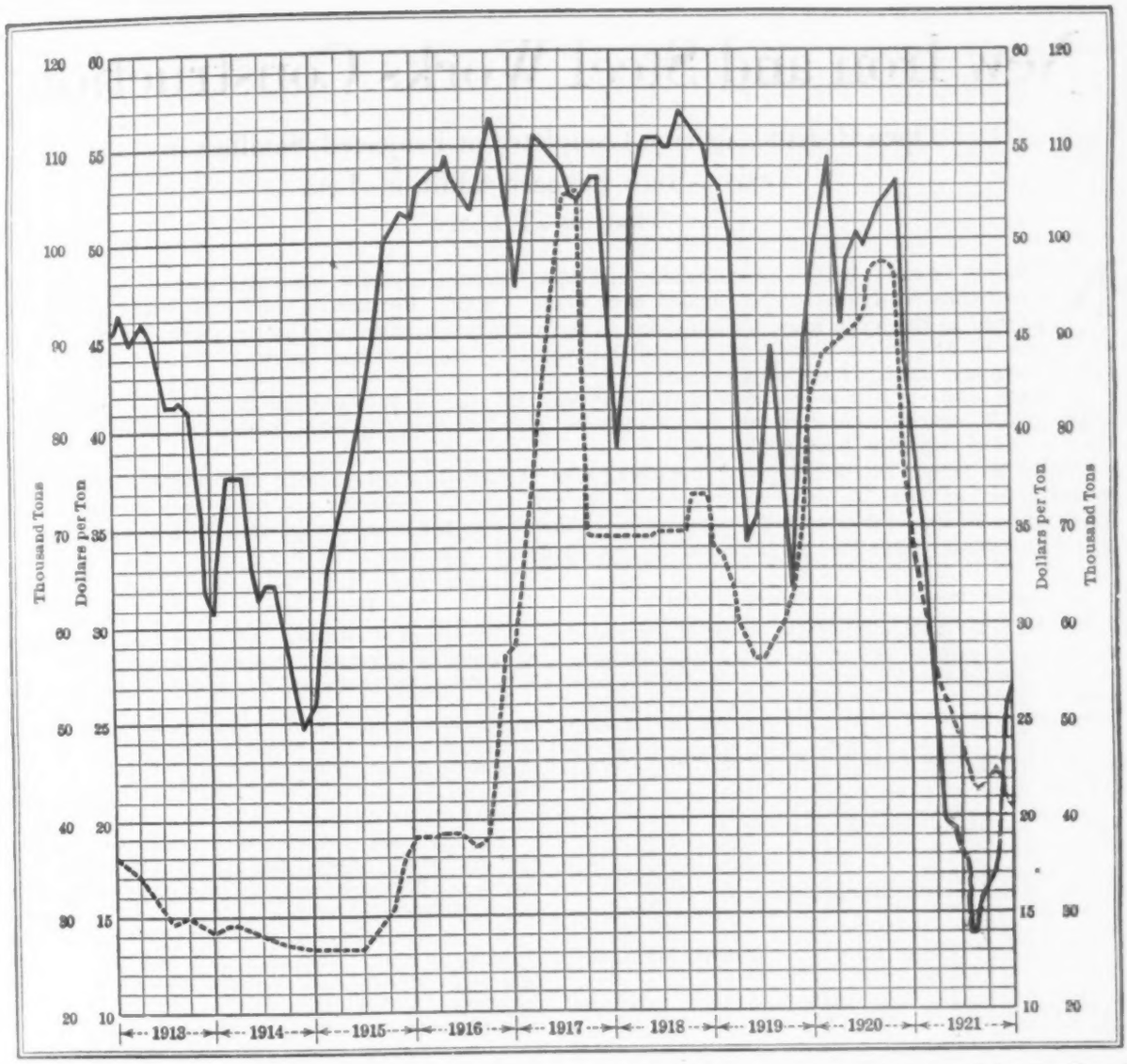
The fluctuations in pig iron production from 1913 to the present time are shown in the accompanying chart. The figures represented by the heavy line are those of daily average production by months of coke and anthracite iron. The dotted curve on the chart represents monthly average prices of Southern No. 2 foundry pig iron at Cincinnati, local No. 2 foundry iron at furnaces in Chicago, and No. 2X at Philadelphia. They are based on the weekly quotations of THE IRON AGE.

Production of Coke and Anthracite Pig Iron in the United States by Months, Beginning Jan. 1, 1917—Gross Tons

	1917	1918	1919	1920	1921
Jan.	3,150,938	2,411,768	3,302,260	3,015,181	2,416,292
Feb.	2,656,247	2,319,299	2,940,168	2,978,879	1,937,257
Mar.	3,251,352	3,213,091	3,090,243	3,375,907	1,595,522
Apr.	3,334,960	3,288,211	2,478,218	2,739,797	1,193,041
May	3,417,340	3,446,412	2,108,056	2,985,682	1,221,221
June	3,270,055	3,323,791	2,114,863	3,043,540	1,064,833
July	3,342,438	3,420,988	2,428,541	3,067,043	864,555
Aug.	3,247,947	3,389,585	2,743,388	3,147,402	954,193
Sept.	3,433,954	3,418,270	2,487,965	3,129,323	985,529
Oct.	3,303,038	3,486,941	1,863,558	3,292,597	1,246,676
Nov.	3,205,794	3,354,074	2,392,450	2,934,908	1,415,481
Dec.	2,882,918	3,433,617	2,633,268	2,703,855	1,649,086
Ttl. yr.*	38,185,981	38,506,047	30,582,878	36,414,114	16,543,686

*These totals do not include charcoal pig iron. The 1920 production of this iron was 323,396 tons.

The Kelly Nail & Iron Co. reports that its Sarah furnace at Ironton, Ohio, will blow in the first week in January.



The Full Line Represents the Daily Production of Pig Iron and the Dotted Line Is the Average of the Price Per Ton of No. 2 Southern Pig Iron at Cincinnati, Local No. 2 Iron at Chicago and No. 2X Iron at Philadelphia

WILL DELAY TARIFF BILL

Probable Effect of Death of Senator Penrose—Senator McCumber Will Be Chairman

Washington, Jan. 3.—The death of Senator Penrose of Pennsylvania, chairman of Committee on Finance, is not expected to change plans for preparing the tariff bill nor will it be likely to change the policy as to the system of valuation for imposing duties or prospective rates. Senator McCumber of North Dakota, who will succeed to the chairmanship, is in sympathy with the protective policy of Senator Penrose and, if anything, is more of a protectionist with respect to agricultural products than the late senator from Pennsylvania was. One important result of the death of Senator Penrose is to swing the powerful position of chairmanship of the committee from a senator from an industrial State of the East to one from an agricultural State of the West.

Coming from Pennsylvania, Senator Penrose undoubtedly showed more interest in and understanding of the steel schedule than has been manifested by Senator McCumber, but it is believed the latter is largely in accord with the views of Senator Penrose toward the schedule. Senator McCumber plainly is of the opinion that manufactured products require fair protection but that the same is also true of agricultural products. In this connection, it is recalled that the late Senator Penrose during hearings on the steel schedule declared that the requests for protection made by steel producers were more modest than those of any other interest.

It is a source of interest as to whether the vacancy in the committee will be filled by a senator from an industrial State or one from an agricultural section. The death of Senator Penrose may have the effect of further delaying passage of the tariff bill, for it is well recognized that his remarkable ability and strong personality were being relied upon to aid in getting the bill through the Senate as quickly as possible.

COMING MEETINGS

January

American Engineering Council. Jan. 5 and 6. Meeting at Cosmos Club, Washington. Secretary, L. W. Wallace, Washington.

February

American Boiler Manufacturers' Association. Feb. 13. One-day winter meeting. Fort Pitt Hotel, Pittsburgh. Secretary, H. N. Covell, 191 Dikeman Street, Brooklyn, N. Y.

American Institute of Mining and Metallurgical Engineers. Feb. 20-25. Spring meeting. Engineering Societies Building, New York. Secretary, Frederick F. Sharpless, 29 West Thirty-ninth Street, New York.

New Iron and Steel Works Construction

Open Hearth Capacity, Completed or Projected, Smallest in Years—Blast Furnace Additions Less Than in 27 Years

NEW low records, both in open-hearth and blast furnace capacity completed and in new capacity under construction as the year ended, were made in 1921. Because of the year's severe depression, as well as the large war-time additions to the country's producing capacity, expansion was not to be thought of, and only a part of the work under way early last year was finished. This is true of both open-hearth and blast furnace construction.

In blast furnaces it is necessary to go back at least 27 years to find any parallel, while in open-hearth building the capacity completed and projected is not only less than that of a year ago but is much smaller than anything recorded in over 10 years.

The high record for new capacity completed was in 1917—97 open-hearth furnaces having an estimated output of 4,326,500 gross tons per year. In new capacity projected and under way the record was 72 furnaces in 1916, representing a capacity of 4,515,000 tons per year. In pig iron the maximum records were 14 furnaces completed in 1917 and 25 new furnaces under way in 1916.

New Open-Hearth Capacity in 1921

In 1921 the new open-hearth capacity completed amounted to only 247,500 gross tons. This compares with 675,000 tons added in 1920 and with 625,000 tons added in 1919—the leanest years at that time in many. The summary below shows 8 open-hearth furnaces completed in 1921 as compared with 20 in 1920 and 9 in 1919. The 1921 additions in the form of a table follows:

New Open-Hearth Furnaces Completed in 1921

	No. of Furnaces	Annual Capacity Gross Tons
Independent Companies	8	247,500
United States Steel Corporation	0	.....
Total	8	247,500*

*Includes Bessemer plant (one 15-ton converter and a 600-ton mixer) of the Steel & Tube Co. of America at Indiana Harbor, Ind.

The additions to open-hearth capacity in 1921 were the following:

Kansas City Bolt & Nut Co., Kansas City, Mo., one 50-ton furnace; Follansbee Brothers Co., Toronto, Ohio, four 40-ton furnaces; National Steel Foundries, Milwaukee, Wis., two 25-ton furnaces and Adirondack Steel Foundries, one 25-ton furnace. The Central Iron & Steel Co., Harrisburg, Pa., enlarged one 50-ton to a 90-ton furnace last year.

The United States Steel Corporation made no additions to its open-hearth capacity at any of its plants last year. This was also true of 1920.

Open-Hearth Construction for 1922

Open-hearth furnaces under construction, most of which will probably be completed in 1922, number 6, which compare with 15 projected in 1921 and with 22 in 1920. In 1916 there were 91 furnaces projected but their estimated capacity of 4,265,000 tons per year was less than that of the 72 projected for 1917. The total estimated capacity of the furnaces projected for completion in 1922 is only 217,500 gross tons. This compares with 430,000 tons planned for 1921, with 875,000 tons for 1920 and with 1,130,000 tons for 1919.

New installations contemplated for 1922 are as follows:

Mansfield Sheet & Tin Plate Co., Mansfield, Ohio, four 75-ton furnaces; Kansas City Bolt & Nut Co., one 50-ton furnace and Ohio Steel Foundry, Lima, Ohio, one 25-ton furnace. The Central Iron & Steel Co., Harrisburg, Pa., plans to enlarge one 40-ton to a 90-ton furnace this year.

The United States Steel Corporation makes no mention in its report of any additions to its melting capacity in 1922.

Expressed in the form of a table the proposed new open-hearth capacity is as follows:

New Open-Hearth Furnaces Under Construction for 1922

	No. of Furnaces	Annual Capacity Gross Tons
Independent Companies	6	217,500
United States Steel Corporation	0	.....
Total	6	217,500

New Blast Furnace Construction

The record of additions to pig iron making capacity, exclusive of charcoal furnaces, is the smallest since 1914. Last year only one furnace was completed and it has not yet been blown in; in 1914 also only one furnace was completed. In 1920, there were 6 furnaces completed but in 1919 only 2. In 1918 the records show 8 furnaces completed and in 1917 there were 14. The one furnace completed last year represents a capacity of 180,000 gross tons of pig iron per year.

For 1922 our statistics show that there are two furnaces under construction for probable completion this year. These represent an estimated new capacity of 310,000 tons per year.

In the annual review issue of THE IRON AGE, Jan. 7, 1915, it was stated that new pig iron making capacity, completed and projected, was the smallest in 20 years. At that time only one furnace had been completed the year under review and there were three furnaces projected. With only one furnace completed in 1921 and two under way for completion in 1922, the present status of expansion is the smallest in 27 years.

The following table gives the details of new blast furnaces completed in 1921 and at present under construction:

Company	Completed in 1921	Under Construction or Projected
Trumbull Cliffs Furnace Co., Warren, Ohio	1	.
E. W. Mudge & Co. (Claire No. 1), Sharpsville, Pa.	.	1
Hamilton Furnace Co., Hamilton, Ohio	.	1
Total	1	2

Several companies rebuilt or are rebuilding their furnaces or plan to do so which will add materially to their capacity and efficiency. The new furnace of the Hamilton Furnace Co. and of E. W. Mudge Co., while replacing old furnaces, are being erected on new foundations.

The Steel Corporation

New construction completed during 1921 and that under way as of Jan. 1, 1922, by subsidiary manufacturing companies of United States Steel Corporation, is as follows:

Carnegie Steel Co.

Completed

Edgar Thomson Works: Additions to crane facilities in Nos. 2 and 3 foundries and foundry roll and machine shop; facilities and equipment for repairing plant locomotives; additional 1000-k.w. motor generator set in power house, and replacement of condenser air pumps in blast furnaces and No. 1 mill engine rooms.

Duquesne Works: Improved slag handling method at blast furnace No. 6.

Homestead Works: Six 125-ton pouring cranes at open-

hearth plant No. 3; hydraulic pumps and pressure system at 32-in. slabbing mill to serve the 32-in., 72-in., 84-in. and 140-in. mills and open-hearth plants Nos. 1 and 2; rebuilding two 5-hole banks of pit furnaces and installing transfer car at 32-in. slabbing mill and motor drive for 33-in. finishing mill.

Carrie Furnaces: Five 40-ton hot metal ladles and cars and six cinder ladles and cars.

Schoen Steel Wheel Works: Additional wheel-finishing machinery.

Ohio Works: New boiler plant and reinforcing bin system at blast furnaces Nos. 1 to 4.

McDonald Mills: 18-in. band mill and 10-in. hoop mill.

New Castle Works: Dry gas cleaner for blast furnace No. 1.

Farrell Works: Reconstruction of blast furnace No. 2 and electric handling equipment for cinder and refuse on pouring side of open-hearth department.

Clairton Works: Equipping six blooming mill boilers to burn coke breeze; twenty flat cars for open-hearth department and two additional primary coolers at by-product coke plant.

Under Way

Edgar Thomson Works: Six roll lathes for roll shop and a Greenawalt sintering plant No. 2 at briquetting plant.

Duquesne Works: Reconstruction of blast furnace No. 3 and stock yard.

Homestead Works: Tar burning system for open-hearth plant No. 3.

Carrie Furnaces: Increasing height of blast furnace No. 5.

Ohio Works: Reconstruction of three open-hearth furnaces.

Mingo Works: Three new hot blast stoves at blast furnace No. 2 and dry gas cleaner for blast furnace No. 3.

Illinois Steel Co.

Completed

South Works: Three waste heat boilers at No. 3 duplexing open-hearth plant.

Gary Works: Enclosing billet and blooming mill chipping yards; 200-ft. extension to electrical repair shop and additional equipment, and three coal unloading machines and enlarging unloading building at by-product coke plant.

Under Way

South Works: Gas engine driven electric power station.

Joliet Works: Rebuilding four batteries of ovens and regenerator walls at by-product coke plant.

Milwaukee Works: Extending building and crane runway at 9-in. merchant mill No. 2.

Gary Works: 12-in. and 20-in. strip mills.

Universal Portland Cement Co.

Completed

Buffington, Ind.: Additional kiln unit in burner building at mill No. 6.

Universal, Pa.: Coal drying and pulverizing plant; dust collecting system on kiln and dryer stacks and raw material building and dwelling houses and recreation center for employees.

Under Way

Buffington, Ind.: Dust collecting system in raw material building at mill No. 6 and water filtering and softening plant to serve mills Nos. 3, 4 and 6.

Universal, Pa.: Increasing raw material grinding capacity and clinker storage.

Minnesota Steel Co.

Completed

Duluth Works: Additions to 28-in. rail mill and extending ore, coal and stone storage yard.

Under Way

Duluth Works: Rod and wire mill and townsite extension and additional dwellings for employees.

Lorain Steel Co.

Completed

Johnstown Works: Extensions to iron and steel foundries buildings and new pattern storage building.

Under Way

Johnstown Works: Electric steel foundry with 4-ton electric furnace.

National Tube Co.

Completed

Lorain Works: two lap weld mills, additional coupling shop machinery and extension to machine shop; extending blacksmith shop building and installing 1000-ton hydraulic forging press and 15-ton electric overhead traveling crane; stoker equipment for six boilers in by-product coke plant boiler house.

National Works: Ore thawing house at blast furnaces.

Continental Works: Equipment for making couplings, ½-in. and ¾-in. sizes.

Ellwood Works: Equipment for forming automobile axles, torque tubes, etc.

Under Way

Lorain Works: Rebuilding blast furnace No. 4; additions at slag crushing plant, and modernizing coupling finishing machinery.

National Works: Rebuilding blast furnace No. 2; remodeling pig casting machine.

Christy Park Works: Extensions to "horn" welding department to increase capacity.

American Steel & Wire Co.

Completed

Cuyahoga Works: Facilities for handling and storing hot rolled flats at Nos. 1 and 3 strip mills; patenting furnace and equipment for spring wire.

Newburgh Steel Works: New water cooling towers at reservoir.

Central Furnaces: Additions to slag crushing plant.

H. P. Works: New boiler plant.

Waukegan Works: New boiler plant.

Scott Street Works: Water filtration plant.

Braddock Works: Four additional annealing furnaces.

Worcester, North Works: Additional electro-galvanizing equipment.

Under Way

Cuyahoga Works: New machine and electric repair shop buildings with equipment and additional storehouse facilities.

American Works: Additional pot annealing facilities.

Salem Works: Twenty double blow roofing nail machines.

Braddock Works: Additional cleaning house facilities and rearranging equipment.

Trenton Works: Extension to rope shop and equipment to manufacture special rope for export.

Worcester, North Works: Continuous cold rolling equipment for flat wire.

Worcester, Electrical Cable Works: Extension to building, additional equipment and rearranging old facilities to modernize plant and to increase capacity of electrical cable department.

Donora Steel Works: Improved cinder handling facilities in open-hearth department.

Donora Wire Works: Building and equipment to manufacture electric-welded concrete reinforcement.

American Sheet & Tin Plate Co.

Completed

Gary Works: Motor drive for finishing stand at No. 2 plate mill.

American Works: Three 685 w.t. boilers with stokers and auxiliary facilities.

Laughlin Works: New hot mill engine and drive.

Chester Works: Rebuilding hot mill furnaces Nos. 1 to 5 and equipping furnaces Nos. 1 to 8 with stoker equipment.

Under Way

Vandergrift Works: New pickling and galvanizing department buildings and equipment; new engines and drives for mills Nos. 1, and 2 and new furnaces for 8 hot mills.

American Bridge Co.

Completed

Pencoyd Works: Additional generating capacity for electric power.

Under Way

Pencoyd Works: New cranes and crane runway over charging floor and pouring side in open-hearth department.

Tennessee Coal, Iron & Railroad Co.

Completed

Ensley Works: Dry gas cleaner for blast furnace No. 3.

Fairfield Works: Additions to finishing end at bar and structural and plate mills and tie plate finishing department.

Pratt Mines: Opening and equipping No. 18 mine—Hamilton slope.

Under Way

Ensley Works: Rebuilding blast furnace No. 1 and 5000-kw. frequency changer at No. 1 power house.

Federal Shipbuilding Co.

Completed

10,000-ton capacity floating dry dock and auxiliary facilities.

Bethlehem Steel Corporation

The subsidiary companies of the Bethlehem Steel Corporation report the following improvements and additions completed in 1921 and under way at the close of the year at their various plants:

Bethlehem Plant, Bethlehem, Pa.

Completed in 1921: Ore and limestone bins and trestles for open hearth No. 2; converting machine shop No. 5 to a fabricating shop for light sections; machine for cutting herring bone gears; new gas blowers for exhaust house at coke plant.

Under Way: Centrifugal casting machine for brass foundry; extension to 28-in. billet mill building.

Steelton Plant, Steelton, Pa.

Completed in 1921: Generator set in power house; crane run-way for steam blowing engine building; service building at steel foundry.

Under Way: Fitting 35-in. mill manipulators with electric drive; installation of 6-ton electric furnace at steel foundry.

Lebanon Plant, Lebanon, Pa.

Completed in 1921: 300 kw. motor generator set; additions and improvements at boiler house, one 10,000 kw. turbogenerator for power station; two roll turning lathes; factory warehouse and finishing department; one spike machine; seven drag furnaces, 15 automatic bolt threading machines; two machines for nut shop; two over-fired heat treating furnaces.

Under Way: Improvements and extensions to concentrating and sintering plant; cooper shop and galvanizing department; remodeling old nut warehouse building for storeroom purposes; wire treating and pickling department; one special knuckle press for hexagon nuts; two thread rollers.

Maryland Plant, Sparrow's Point, Md.

Completed in 1921: One hundred houses and 100 bungalow type dwellings; aeration equipment for town water supply; five gas driven electric generators; extension to ore unloader; gas compressor and motor; 200 ft. extension to billet and sheet bar storage run-way at 40-in. blooming mill; dispensary and employment office at sheet and tin plate plant; stretcher leveler for sheet mills.

Under Way: Concrete anchorage and ties at coal handling dock; seven gas driven blowing engines; tracks at cinder dump; coal crusher for No. 2 open-hearth gas producers; coal crusher for 46-in. blooming mill gas producer; one roller leveler for sheet and tin plate mill.

Mining and Other Operations

The Bethlehem Chile Iron Mines Co., Chile, completed in 1921: Parts for electric power equipment; one light house complete and a new ore crusher and has under way improvements to basin dock and electric railroad.

The Bethlehem Cuba Iron Mines Co., Cuba, completed in 1921: Village improvements; equipment for power plant; one hundred ore cars; one 50-ton electric driven transfer car; one lighter; coal drying and pulverizing plant; concrete substructure for gantry run-way; aerial tramway; screening, recrushing and hoisting plant for ore at La Playa.

The Cornwall Ore Banks Co., Cornwall, Pa., completed in 1921: Plant for shaft sinking; one 300-ton electric revolving shovel and new railroad track for stripping and has under way equipment for open cut mining and one centrifugal pump.

Of the coal properties, the Preston Division, West Va., completed in 1921, houses and land for town; additional locomotives, pumps, mine cars and mining machinery; transmission line and feed wire for direct current, and has under way substation and motor barn; thirty 3-ton mine cars; additional tracks and trolley facilities for all mines; one 300 kw. power unit at mines Nos. 21, 24 and 27 and transmission line.

At the Marion Division, West Va., there was completed in 1921 twenty houses and community improvements at mine No. 41; fans and steam engine and motor at mine No. 41; and has under way one 15-ton locomotive at mine No. 41; 30 houses and locomotives, mine cars and pumps at mine No. 42.

At the Hellwood Division, Hellwood, Pa., there was completed in 1921 improvements to mine tipple at mine No. 6; new mining equipment and tenement houses at mine No. 9; water barns and fire house at all mines; pumps, hoists and mining machines at all mines, and has under way additional mining machinery and transmission lines.

For ocean transportation, the corporation has under way: Three steel combination ore and oil steamers and two steel combination ore and coal steamers of about 20,000 dead weight tons each.

Midvale Steel & Ordnance Co.

The following work has been completed during the past year at the different plants of the Midvale Steel & Ordnance Co.:

Cambria Steel Co., Johnstown, Pa.: Coaling station for yard locomotives, 800-ton per day plant for sintering flue dust; hot metal ladles, trucks and tilting rigs at pig casting plant, also changes at Bessemer plant; two ore bridges for Hinckton Run ore yard; 51 gas producers, entire new equipment of gas valves, ore and limestone bins and sewer system for Franklin open-hearth department; retaining wall from Nos. 10 and 11 blast furnaces to Franklin open-hearth metal mixer; charging machine for Franklin open-hearth; four soaking pit furnaces at Franklin 40-in. blooming mill; eleven 60-in. Sellers turning machines for wheel plant; tube system for tests at Franklin open-hearth; relining stoves on No. 9 blast furnace; coke handling and conveying systems at Nos. 7, 8, 9, 10 and 11 blast furnaces; three 12,000-gal. quenching tanks, together with circulating pumps for Franklin coke plant; plant for the manufacture of the Henggi anti-rail creepers; new motor drives for 8-in. No. 3 and 9-in. No. 1 merchant mill.

Nicetown Works: Alteration of the No. 1 tire mill for rolling large rings, rearrangement and improvement to 8-in. and 12-in. rolling mill equipment and extension to the press plant building, 160 ft. by 172 ft.

Coatesville Works: A 22-in. skelp mill for the tube plant; electric worm driven screw down No. 2 plate mill and 10 steel gondola cars.

Union Coal & Coke Co.: Link belt rotary dumps for Hazelkirk mine; electrification of Hazelkirk and Acme mines; new hoists for Acme mine; two new pumps for Hazelkirk mine; reinstall filtration plant at Marianna and the purchase of additional coal lands.

New work under construction for completion in 1922 is as follows:

Cambria Steel Co.: 148 coke ovens complete with by-product and light oil recovering apparatus and by-product plant for present coke ovens, together with benzol plant for all coke ovens; three hot stoves at No. 5 blast furnace; 16-in. water line from Gautier to Franklin plant; two dry gas cleaners for Nos. 5 and 6 blast furnaces; relining No. 6 blast furnace; motor-driven shear at 14-in. mill; 8000-hp. modern boiler installation for Franklin plant; ore and limestone bins for blast furnaces Nos. 7, 8 and 9; replacement of entire Franklin open-hearth roof; extension of car shop to increase output of standard cars, and also for the manufacture of tank cars; toilets and lavatories at Nos. 7, 8 and 9 blast furnaces; relining Nos. 7 and 8 blast furnaces and three stoves; two wheel facing machines for wheel plant; replacing walls and roof of washery building at Franklin coke plant; new ore bridge at Franklin blast furnaces; fifth soaking pit furnace at Franklin 40-in. blooming mill; further electrification of rolling mill mine; rotary screen conveyor and bins at Carlim quarries; 300 steel mine cars for rolling mill mine; completing Nos. 5 and 6 mines at Rosedale; townsite and 89 houses adjoining Johnstown City; toilets, lavatory and locker facilities for Cambria plant and steel car department.

Coatesville Works: Waste heat boilers for open-hearth department; two coal-fired heating furnaces with waste heat boilers; roll lifting cylinder for No. 3 plate mill; low pressure water system at tube mill; coke dust screening and loading equipment at blast furnace; relining of No. 1 blast furnace; extension to scrap yard crane runway at tube mill and extension of three bays skelp mill yard.

Union Coal & Coke Co.: Development of new mine near Marianna; link belt rotary dump, new fan and mechanical screening arrangements at Acme mine.

Kansas City Bolt & Nut Co.

The Kansas City Bolt & Nut Co., Kansas City, Mo., reports that at the Sheffield steel mills the new steel plant addition was expected to be in complete operation before the end of 1921. Construction was started in August, 1919, and one 50-ton oil fired open-hearth furnace was lighted in October, 1920. The second furnace was completed and lighted in the spring of this year. Foundations are in for the third furnace, which will

mean an annual production of ingots amounting to 120,000 tons.

The 24-in. breaking down mill, reducing 10-in. x 10-in. ingots to billets, started in January, 1921, and has run continuously 8 hr. per day. At present only the first stand of this mill is operating. Three additional stands for finishing merchant bars and structural shapes have been installed, but the cooling bed has not been completed. A continuous heating furnace serving this mill is also oil-fired.

The finishing mills have just been completed. Billets are conveyed automatically from the 24-in. mill to a reheating furnace; from this furnace they enter a four-stand 12-in. Morgan continuous roughing mill, thence to a five-stand 10-in. merchant mill equipped with repeaters, and sizes 9/16 in. round and lighter will be repeated to a two-stand 8-in. Morgan high-speed finishing mill. Finished bars will be delivered from the 10-in. or 8-in. mill to an automatic cooling bed and conveyed from there to the shears and shipping department. These mills are all electrically driven and all buildings are equipped with overhead cranes.

This plant is separate from but operated in conjunction with the iron mills and bolt and nut department. The annual tonnage of finished product will depend largely on the degree of refinement, but will be approximately as follows: Merchant bars, concrete reinforcing bars and forging billets, 75,000 tons. The remainder will be made up of machine bolts and nuts; heat-treated track bolts and spikes; pull and sucker rods for the oil fields; special car forgings and galvanized pole line hardware.

In 1922 the cooling bed for the finishing end of the 24-in. mill will be completed, which will produce angles, channels and I-beams, and should the demand increase, space has been provided for two additional 50-ton open-hearth furnaces, making a total of five furnaces.

Inland Steel Co.

The Inland Steel Co., Chicago, practically completed in 1921 the following changes and additions:

250-ton powdered coal plant;
Railroad splice bar department;
Finishing department for 28-in. structural mill material, including three 10-ton and two 15-ton cranes;
Calcining plant for No. 1 (Old open-hearth plant);
Completion of changes in plate mill to 160 in. wide rolls, and additional housings, making a tandem mill and nearly doubling its capacity;
2 plate mill heating furnaces;
7 boilers, aggregating 7000 hp.;
Additional cranes and shears for sheet mill operations.

For 1922 no new construction is planned except rail finishing, details of which have been already published. Although no additions have been made to the blast furnace or open-hearth capacity, the company states that the output of finished products will show an increase of about 33 1/3 per cent.

Worth Steel Co.

The Worth Steel Co., Claymont, Delaware, in August, 1921, put in operation its No. 2 plate mill having rolls 42 in. x 120 in. This new mill, together with the company's No. 1 mill, enables it to produce a complete line of plate sizes from ⅛ in. in thickness up to 4 in. or heavier and all widths up to 150 in. In January, 1921, the company lighted its No. 6 soaking pit and its No. 7 soaking pit in October, having previously started its No. 5 soaking pit in December, 1920. Pit No. 8 is practically finished and can be made ready to light at any time this year when business will warrant it. Stacks are also in position for No.'s 9 and 10 soaking pits and for No.'s 5, 6 and 7 open-hearth furnaces. These latter additions to the plant can be finished at any time when required within two or three months.

The first unit of the new Worth plant was completed and put in operation late in August and early in September, 1918, and consisted of one 3-high train of rolls 44 in. x 160 in., served by 4 soaking pits and also a steel plant having three 100-ton open-hearth furnaces and in 1920 the company enlarged its open-hearth building so that it could install additional furnaces to double the original capacity; it also added to its rolling mill buildings so as to take care of No. 2 mill which was being built in 1920. Open-hearth furnace No. 4 was finished and lighted in July, 1920. The company also started building in 1920 an up-to-date flanging department which was put in operation in April, 1921.

Central Iron & Steel Co.

The Central Iron & Steel Co., Harrisburg, Pa., in 1921 rebuilt one open-hearth furnace, increasing its capacity from 50 to 90 tons. The open-hearth department now consists of one 50-ton and four 90-ton furnaces and work is in progress to enlarge the sixth furnace to 90-ton capacity.

Installations have also been completed for soda ash treatament of boiler water to a capacity of 600,000 gal. per 24 hr.

Central Steel Co.

The Central Steel Co., Massillon, Ohio, last year completed the erection of a 12-in. and an 18-in. merchant bar mill having a combined capacity of 18,000 tons per month. This company added a new finishing mill building, a new annealing department, pickling house and store room to its Massillon rolling mill plant. The sheet capacity of this unit was increased to 60,000 tons. To its National Pressed Steel plant it added a warehouse and an addition to the steel lumber mill building. A new mill for the cold rolling of steel lumber sections was installed and also a new furnace for heating slabs for the hot strip mill. The company's hot rolled strip steel capacity was increased to 90,000 tons per year, and its steel lumber capacity to 60,000 tons per year. A metal lath department was also added for the manufacture of diamond mesh lath.

Ashtabula Steel Co.

The Ashtabula Steel Co., Ashtabula, Ohio, which began the erection of a steel plant during 1920, slowed down on construction work last year because of general business conditions, but this plant is approaching completion. The company, however, does not expect to begin operations before late in the Spring. The plant will have 5 roughing stands, 8 sheet mills and 2 stands of cold rolls, all driven by a 1600-hp. engine, 8 combination sheet and pair furnaces, 6 sets of shears, a double continuous annealing furnace, 2 galvanizing pots and a corrugating machine. Powdered coal will be used exclusively for firing the boilers and furnaces.

Otis Steel Co.

The Otis Steel Co., Cleveland, last year completed and placed in operation a new sheet mill plant as a part of its Riverside Works. This plant contains 8 roughing and 8 finishing mills, 8 double sheet and 8 pair furnaces fired with powdered coal, 6 cold rolls, 2 pickling machines, 6 bar annealing furnaces and 1 galvanizing pot. The plant has an annual capacity of 60,000 tons of sheets in all finishes.

United Alloy Steel Corporation

The United Alloy Steel Corporation, Canton, Ohio, completed the installation and placed in operation, last year, a 12-in. 2-high continuous Morgan bar mill consisting of two 18-in. and four 16-in. roughing stands and 4 finishing stands. The equipment includes 2 Morgan gravity discharge heating furnaces and a double Morgan combination inclined gravity and horizontal type cooling bed. The mill is driven by a 3000-hp. adjustable speed motor. The rolling capacity of the mill is 120,000 tons per annum. It is designed particularly for alloy steel.

Mansfield Sheet & Tin Plate Co.

The Mansfield Sheet & Tin Plate Co., Mansfield, Ohio, has under construction four 80-ton open-hearth furnaces, a 32-in. three-high blooming mill and a 24-in. sheet bar mill which are expected to be ready for operation early this year.

Trumbull Steel Co.

The Trumbull Steel Co., Warren, Ohio, last year increased the capacity of its strip steel department by the completion of a 9-in. strip mill which was placed in operation about May 1 and is erecting a 14-in. strip mill which will be ready for operation in the Spring.

Republic Iron & Steel Co.

The Republic Iron & Steel Co., Youngstown, Ohio, completed and put in operation in 1921 the eight new sheet mills which it built at Niles, Ohio. This is the only new capacity added last year and there are no plans for additional new capacity for 1922.

John A. Roebling's Sons Co.

John A. Roebling's Sons Co., Trenton, N. J., in 1921 added to its equipment new wire rope making machinery as required to properly balance methods of manufacture, increased rope wire drawing capacity and equipment to reduce cost of handling materials. The company has under construction a new shop for the electro-galvanizing of wire which will materially increase present capacity and which is expected to be in operation early this year.

Follansbee Brothers Co.

Follansbee Brothers Co., Pittsburgh, will have ready for operation early in January its new mill at Toronto, Ohio, built especially for the manufacture of sheet steel. This plant will have four 40-ton open-hearth furnaces and 10 hot mills, with the necessary cold rolling and finishing departments.

Utah Steel Corporation

The Utah Steel Corporation in 1921 installed a continuous billet heating furnace, designed by Arthur G. McKee & Co., replacing two coal-fired, hand-operated, 4-door heating furnaces. The new furnace is equipped to burn either producer gas or oil. It also installed a 5-ton Barber-Foster overhead traveling crane to serve this furnace from the billet dock. Also there was installed a large oil storage tank, oil-burning equipment for open-hearth furnaces, as well as for the ingot and billet heating furnaces. It is now possible to use either fuel oil or producer gas as may be most economical at the time.

"This year," says the company, "we increased our capitalization to $5,000,000 and are now financing for the construction of a 400-ton blast furnace, the installation of sheet mills and a galvanizing department, with capacity for the manufacture of 50,000 tons per annum of blue annealed, black and galvanized sheets and light plate. We expect to start construction work on both the sheet mills and the blast furnace early in the spring. Our construction program also contemplates the addition of three stands of rolls to our present 22-in. mill, and the installation of a 1500-hp. motor to drive it in place of the present steam engine drive. This mill will be used for the manufacture of sheet bar as well as finished bar products."

Gulf States Steel Co.

The Gulf States Steel Co., Birmingham, Ala., in 1921 completed the installation of two 2000-kw. alternating current, low-pressure turbogenerating units, driven by the exhaust steam from the company's rod mill engines. During 1921 the company has also completed the slope at its Shannon ore mine, together with all outside and inside equipment, and its mine is now in regular operation producing all the ore necessary for the company's blast furnace.

Universal Steel Co.

The Universal Steel Co., Bridgeville, Pa., is installing and expects to have ready for operation early in 1922 the following equipment:

One—1000-ton high-speed forging press and boiler plant equipment.
One—5-stand 14-in. 3-high bar mill.
One—5-stand 10-in. 3-high guide mill.
One—3-stand 8-in. 3-high guide mill.

The above mills are to be complete, with all accessories and motors to drive them. A complete and modern laboratory building is also under erection as well as a new pumping and filtering plant to serve the foregoing new equipment.

Apollo Steel Co.

The Apollo Steel Co., Apollo, Pa., completed in 1921 the construction of four sheet mills and two 2-high jobbing mills, during the latter part of the year. These new mills will be put into operation as soon as market conditions justify.

Harrisburg Pipe & Pipe Bending Co.

The Harrisburg Pipe & Pipe Bending Co., Harrisburg, Pa., has under construction a new 10-in. guide mill which will be completed about Jan. 15. It is designed to roll rounds, flats, squares and shapes of both ordinary carbon and alloy steels.

Heppenstall Forge & Knife Co.

The Heppenstall Forge & Knife Co., Pittsburgh, Pa., completed in 1921 the installation of oil storage tanks of approximately 200,000-gal. capacity and remodeled 15 heating furnaces in its forging department, changing the fuel from coal to oil.

At its Bridgeport, Conn., plant it is now remodeling four furnaces, changing the fuel from coal to oil, and has installed oil storage capacity of 50,000 gal.

Other Steel Works Additions

The National Enameling & Stamping Co., Granite City, Ill., in 1921 completed the installation of a 24-in. bar mill for sheet bars, having a capacity of 1200 tons per day.

The Judson Mfg. Co., Emeryville, Cal., in 1921 installed continuous furnaces and long hot beds and plans in 1922 to install double-end oil furnaces. It is expected that the annual rolling mill production of the company for 1922 will be about 90,000 tons.

The Adamson Machine Co., Akron, Ohio, in 1921 completed an extension to its power house having a floor area of approximately 1000 sq. ft.

The Washburn Wire Co., Phillipsdale, R. I., had under way the modernizing of its blooming mill.

The West Leechburg Steel Co., Pittsburgh, Pa., expects to install in 1922 a new 16-in. electrically driven continuous strip mill together with the necessary auxiliary equipment, including pickling department and warehouse.

The Jones & Laughlin Steel Co., Pittsburgh, at its Soho Works installed in 1921 a 32-in. universal mill, furnished by the Mackintosh-Hemphill Co.

NEW ROLLING MILL WORK

Installations of new rolling mill capacity during 1921 and that planned for 1922 are as follows:

Calumet Steel Co.

The Calumet Steel Co., Chicago Heights, Ill., placed in operation in 1921 new motor driving equipment for its mills. Its two 14-in. mills are operated by two 1000-hp. variable speed, Kraemer type motors installed by the Westinghouse Electric & Mfg. Co. Its 8-in. mill has been equipped with 500 hp. constant speed motor.

Eddystone Steel Co.

The Eddystone Steel Co., Crum Lynne, Pa., added to its plant during 1921 the following:

A 60-in. 3-high plate mill, for rolling plates up to 50 in. wide and down to No. 16 gage.

A continuous blue annealing furnace, for production of blue annealed steel sheets from No. 8 gage down to No. 16 gage and up to as wide as 48 in.

It is planned to install a 72-in. 3-high plate mill during 1922, or as soon as business conditions revive.

These two mills will give the company a capacity of about 25,000 tons of open-hearth steel plates and blue annealed steel sheets per year.

Hudson City Steel Corporation

The Hudson City Steel Corporation, with offices in the Woolworth Building, New York, expects to build in 1922 a new cold rolled strip mill near Beacon, N. Y. This will consist of:

Ten mills in the form of two tandems or four mills each 10 in. x 12 in. and 12 in. x 14 in. respectively.

Two finishing mills, 10 in. x 12 in. and 12 in. x 14 in. respectively.

Two slitters and two straight and cut machines.

Two electric annealing furnaces and necessary equipment required for the annealing and pickling departments, together with necessary equipment for machine shop and blacksmith shop.

Indiana Rolling Mill Co.

The Indiana Rolling Mill Co., New Castle, Ind., in 1921 completed the installation of a new 28-in. sheet mill of three stands; in connection with this there was also installed a new Corliss engine and a new furnace for re-heating slabs. A new office building, two stories, with a basement, is also nearing completion.

Electric Steel & Forge Co.

The Electric Steel & Forge Co., Cleveland, last year completed and placed in operation a 12-in. rolling mill for the manufacture of hot rolled tool steel and special alloy and carbon steel bars and billets. The equipment includes three oil-fired heating furnaces.

Other New Rolling Mill Work

The Parkesburg Iron Co., Parkesburg, Pa., in 1921 besides making thorough repairs replaced five boilers with new ones in its power plant.

The Fort Dodge Culvert & Iron Mills Co., Fort Dodge, Iowa, expects to add in 1922, a 16-in. breakdown mill.

The Milwaukee Rolling Mill Co., Milwaukee, Wis., completed early in 1921, its new sheet plant which was fully described in THE IRON AGE, June 23, 1921.

The Empire Rolling Mill Co., Cleveland, last year installed a 1-pot galvanizing plant.

Additions to Foundries

The Pittsburgh Rolls Corporation, Pittsburgh, in 1921 completed a new roll shop, 295 x 65 ft., for the production of large size rolls. It is equipped with two 50-ton electric driven cranes as well as a number of new lathes and machinery which are also electrically driven. Fuel oil storage tanks, having a capacity of 250,000 gallons, have also been built.

The Ohio Steel Foundry Co., Lima, Ohio, last year put in two large sand handling units, consisting of reciprocating and belt conveyors with elevators and sand conditioning equipment, doubling the company's molding capacity. In 1922, the company expects to build an additional open-hearth furnace doubling the steel producing capacity.

The Adirondack Steel Foundries Corporation, Watervliet, N. Y., in 1921 completed the installation of a 25-ton open-hearth basic furnace.

The National Steel Foundries, Milwaukee, Wis., completed in 1921 the installation of two 252 ton tilting open-hearth furnaces. These, as well as features of the plant, were described in THE IRON AGE, Oct. 20, 1921.

Blast Furnace Work

The Trumbull Cliffs Furnace Co., Warren, Ohio, last year completed a 600-ton blast furnace which will supply pig iron for the Trumbull Steel Co., with which the furnace company is allied. The stack is 92 ft. high and 22 ft., 6 in. in diameter at the bosh. The plant includes a pig casting machine and combined ladle and pouring house. A description of this plant appeared in the Sept. 15, 1921, issue of THE IRON AGE.

The Hamilton Furnace Co., Hamilton, Ohio, has nearly completed a new 450-ton blast furnace for producing basic, malleable and foundry iron. Its dimensions are 90 ft. high with a bosh diameter of 20 ft. Its rated capacity is 175,000 tons per year.

E. W. Mudge & Co., Sharpsville, Pa., has under construction for completion in 1922 a 500-ton blast furnace to be known as Claire No. 1. It replaces, on a new foundation, the old smaller Claire furnace. It is 87 ft. high with a bosh diameter of 19.6 ft. The furnace was started in June, 1920, the old furnace operating 288 days of that year. This was dismantled in 1921 and some of the usable parts incorporated in the new furnace. The new furnace is completed all but lining and it is expected that this will be accomplished in 1922.

The United States Steel Corporation as well as the Bethlehem Steel Corporation and the Midvale Steel & Ordnance Co. are rebuilding several blast furnaces, in some cases increasing their capacity.

Blast furnace No. 2 of the LaBelle Iron Works of the Wheeling Steel Corporation, Steubenville, Ohio, was remodeled in 1921. The Martins Ferry furnace of the same corporation at Martins Ferry, Ohio, is being remodeled as is also the Standish furnace of the Chateaugay Ore & Iron Co., Standish, N. Y.

Puddlers' Wages Reduced

YOUNGSTOWN, OHIO, Jan. 3.—Average sales of bar iron shipped during the 60-day period preceding Dec. 20 by mid-Western independent mills affiliated with the Western Bar Iron Association were on a basis of 1.65c. per lb., as compared with a 1.70c. average two months earlier. This was disclosed at the bi-monthly examination of sales sheets to determine the puddling rate for the January-February period. Puddlers' rate will be reduced to $8.22 for the first two months of the year, from $8.43, the rate paid during November and December, while finishing hands will be cut two per cent, as a result of the settlement.

The new puddling rate compares with a peak in 1920 of $18.76 per ton, paid when bar iron was selling at an average of 3.50c. per lb. During the year there has been a progressive decline at each bi-monthly settlement in the average bar iron price and consequently in the tonnage rates.

January-February shipments this year were on an average of 2.80c.; March-April, 2.55c.; May-June, 2.30c.; July-August, 1.85c.; September-October, 1.70c. and November-December, 1.65c. This averages 2.14c. per lb. for the year and current prices are therefore substantially below the average.

Settlement in the sheet and tin plate divisions will be conducted about Jan. 10. Wages in these divisions for November and December were based upon an average selling price of 2.75c. for Nos. 26, 27 and 28 gage black sheets, and $5 for tin plate per base box, disclosed two months ago. In the meantime, there has been a definite decline in tin plate to $4.75 per base box, shortly after the last examination, and tin mill workers will therefore receive a moderate reduction.

Foundrymen and Stove Molders Agree

After a conference lasting three weeks, representatives of the Stove Foundrymen's National Defense Association and the International Molders' Union of North America came to an agreement regarding the wages to be paid in the stove industry during the year 1922. The agreement provides that beginning Jan. 1, 1922, there will be a reduction of 10 per cent on all work, and in addition a 5 per cent reduction is to be made on board prices on some branches of furnace and steel and hot water work. The reduction on board prices on furnace, steel and hot water work was made to maintain a uniform percentage on all work in the shop. The minimum wage for day workers during 1922 will be the same as that effective during 1921; the rate being $6 for eight hours work. No other changes were made in the conference agreement. The agreement was in the nature of a compromise, the Stove Foundrymen's Association demanding that where board prices had been arbitrarily raised since January, 1918, these prices be reduced to the 1918 board prices. In addition to this, the association demanded a 20 per cent reduction on stove plates and a 30 per cent reduction on furnaces, cores, hot water and all other work.

Iron and Steel Markets

NEW CAR ORDERS

More Than 25,000 Placed and Pending

December Pig Iron Output Beyond Expectations—Steel Prices Favor Buyers

The steel trade enters upon the new year in a spirit of qualified hopefulness. It expects 1922 to be better than 1921. The fact is emphasized that the country has been swept bare of steel and that consumers, having used up considerably more material in 1921 than the mills shipped them, now have the mills as their sole dependence. While capacity will continue well in excess of demand, a 60 per cent operation at some time in the new year is not considered too much to expect.

Nineteen twenty-one goes down in the records as a 38 per cent year in steel. Ingot production probably exceeded 19¼ million tons, against 40,881,000 tons in 1920.

The immediate future of demand and prices is not clear. Steel producers have ceased to predict large railroad buying, but as it amounted to only about 15 per cent of the total in 1920 and less than that percentage in 1921 they feel safe in counting on better things in 1922.

Chicago reports give encouragement as to car orders. About 25,000 freight cars are expected to be placed in that district early in the year, whereas for the whole country 1921 yielded only 20,000. The Burlington will probably close for 7300 cars this week and the Illinois Central will take early action on 2200. The Seaboard Air Line, besides buying 25 locomotives, has placed 2000 to 2500 cars with the Fairfield, Ala., plant. For the Norfolk & Western 4000 cars are under negotiation. The Union Pacific has increased its recent inquiry for 1500 freight cars to 5500.

Rail buying is not on the scale of a year ago. Upwards of 400,000 tons are under contract for 1922 and the Pennsylvania order is an early prospect.

After the holiday shutdowns of the larger steel companies operations are somewhat larger, the Steel Corporation running this week at somewhat more than 45 per cent. For independent companies the average is probably nearer one-third.

Holiday bankings of blast furnaces amounted to much less than was looked for. Production in December was 1,649,086 tons, or 53,196 tons per day, as compared with 1,415,481 tons in November, or 47,183 tons per day. The daily increase was about 6000 tons, or 13 per cent.

Six furnaces blew in last month and one blew out, the number active on Jan. 1 being 125, against 120 one month previous.

Pig iron sales have been very light and no inquiries of importance have developed. Southern pig iron has receded another 50c. to $16.50, Birmingham, and malleable has been marked down 50c. in the Pittsburgh district.

Reports of pending reductions in plate, shape and bar prices by a leading producer have been strongly denied. The 1.50c. basis on these products is that which commonly prevails on contracts made to cover definite work, but exceptions are well marked.

New fabricated steel projects, including some large investment enterprises, total close to 14,000 tons, and the week's awards amount to about half as much. The New York Central has put out an inquiry for its first quarter needs, upward of 6000 tons, including 500 tons of billets, 3000 tons of bars, plates and shapes, 750 tons of nails and staples, 600 tons of sheets, 3000 tires and 5000 car axles, with other miscellaneous items, such as boiler tubes, frogs and switches.

Industrial building is rare, but 5000 tons has been placed at Pittsburgh—3000 tons for a new rod and wire plant of the Wheeling Steel Corporation at Portsmouth, Ohio, and 2000 tons for new Steubenville, Ohio, works of the same company.

New iron and steel capacity under construction at the beginning of 1922 is the smallest in many years. Only 6 open-hearth furnaces are planned for 1922, with an annual capacity estimated at 217,500 gross tons, and only two blast furnaces, with a capacity of 310,000 tons. Last year only 8 new open-hearth furnaces and one Bessemer converter were added, with 247,500 tons annual capacity, and one blast furnace, capacity 180,000 tons. The blast furnace capacity completed last year or under way is the smallest in 27 years.

Pittsburgh

PITTSBURGH, Jan. 3.

Seasonal quiet rules in the iron and steel market, but there also is a pretty general sentiment that before the new year is far advanced business will be materially better, as stocks of iron and steel in consuming and distributing quarters are believed to be extremely moderate. At the same time, there is no indication of an immediate abandonment on the part of buyers of their recent policy of purchasing close to actual needs. While it is contended that present prices completely discount freight rate reductions and wage adjustments among certain kinds of labor, which up to date have not been affected in the general liquidation of the past year, buyers are not convinced that when these things are actually accomplished still lower prices will not be seen The forecast finding the most general acceptance is that orders carrying early shipment instructions will be numerous enough during the first quarter of the year, but that there will not be a great deal of contracting or anticipatory buying before summer.

There has not yet been much change in the opera-

A Comparison of Prices

Advances Over the Previous Week in Heavy Type, Declines in Italics

At date, one week, one month, and one year previous

For Early Delivery

Pig Iron, Per Gross Ton:	Jan. 3, 1922	Dec. 27, 1921	Dec. 6, 1921	Jan. 4, 1921
No. 2X, Philadelphia‡	$21.34	$21.34	$22.34	$34.79
No. 2, Valley furnace†	19.50	19.50	20.50	33.00
No. 2, Southern, Cin'ti†	*21.00*	21.50	22.00	39.50
No. 2, Birmingham, Ala.†	*16.50*	17.00	17.50	35.00
No. 2 foundry, Chicago*	19.00	19.00	20.00	32.00
Basic, del'd, eastern Pa.	20.25	20.25	21.00	33.86
Basic, Valley furnace	18.25	18.25	19.00	30.00
Bessemer, Pittsburgh	21.96	21.96	21.96	33.96
Malleable, Chicago*	19.00	19.00	20.00	32.50
Malleable, Valley	*19.50*	20.00	20.00	32.00
Gray forge, Pittsburgh	20.96	20.96	21.46	33.96
L. S. charcoal, Chicago	31.50	31.50	31.50	43.50
Ferromanganese, del'd	60.00	60.00	60.00	100.00
Rails, Billets, Etc., Per Gross Ton:				
O.-h. rails, heavy, at mill	$40.00	$40.00	$40.00	$47.00
Bess. billets, Pittsburgh	*28.00*	29.00	29.00	43.50
O.-h. billets, Pittsburgh	*28.00*	29.00	29.00	43.50
O.-h. sheet bars, P'gh	*29.00*	30.00	30.00	47.00
Forging billets, base, P'gh	32.00	32.00	32.00	48.50
O.-h. billets, Phila.	33.74	33.74	34.74	49.24
Wire rods, Pittsburgh	*36.00*	38.00	38.00	57.00
	Cents	Cents	Cents	Cents
Skelp, gr. steel, P'gh	1.50	1.50	1.50	2.65
Light rails, at mill	1.55	1.55	1.55	3.00
Finished Iron and Steel, *Per Lb. to Large Buyers:*	Cents	Cents	Cents	Cents
Iron bars, Philadelphia	1.85	1.85	1.95	3.35
Iron bars, Chicago	1.60	1.60	1.65	2.68
Steel bars, Pittsburgh	1.50	1.50	1.50	2.35
Steel bars, Chicago	1.60	1.60	1.60	2.73
Steel bars, New York	1.88	1.88	1.80	2.73
Tank plates, Pittsburgh	1.50	1.50	1.50	2.65
Tank plates, Chicago	1.60	1.60	1.60	3.03
Tank plates, New York	1.83	1.83	1.88	3.03
Beams, etc., Pittsburgh	1.50	1.50	1.50	2.45
Beams, Chicago	1.60	1.60	1.65	2.83
Beams, New York	1.88	1.88	1.88	2.83
Steel hoops, Pittsburgh	2.00	2.00	2.00	3.05

*The average switching charge for delivery to foundries in the Chicago district is 70c. per ton.
†Silicon, 1.75 to 2.25. ‡Silicon, 2.25 to 2.75.

Sheets, Nails and Wire, *Per Lb. to Large Buyers:*	Jan. 3, 1922 Cents	Dec. 27, 1921 Cents	Dec. 6, 1921 Cents	Jan. 4, 1921 Cents
Sheets, black, No. 28, P'gh	3.00	3.00	3.00	4.35
Sheets, galv., No. 28, P'gh	4.00	4.00	4.00	5.70
Sheets, blue an'l'd, 9 & 10	2.25	2.25	2.25	3.55
Wire nails, Pittsburgh	2.50	2.50	2.75	3.25
Plain wire, Pittsburgh	2.25	2.25	2.50	3.25
Barbed wire, galv., P'gh.	3.15	3.15	3.40	4.10
Tin plate, 100-lb. box, P'gh	$4.75	$4.75	$4.75	$7.00
Old Material, Per Gross Ton:				
Carwheels, Chicago	$15.50	$15.50	$16.00	$21.00
Carwheels, Philadelphia	16.50	16.50	17.00	25.00
Heavy steel scrap, P'gh	14.50	14.50	14.00	15.00
Heavy steel scrap, Phila.	11.50	11.50	11.50	14.50
Heavy steel scrap, Ch'go	**11.50**	11.00	11.50	15.00
No. 1 cast, Pittsburgh	*16.25*	16.00	16.50	25.00
No. 1 cast, Philadelphia	16.50	16.50	17.50	22.50
No. 1 cast, Ch'go (net ton)	12.50	12.50	13.00	17.00
No. 1 RR. wrot, Phila.	14.50	14.50	15.50	20.00
No. 1 RR. wrot, Ch'go (net)	**10.50**	10.25	10.50	14.00
Coke, Connellsville, Per Net Ton at Oven:				
Furnace coke, prompt	$2.75	$2.75	$2.75	$5.25
Foundry coke, prompt	3.75	3.75	4.00	6.50
Metals, *Per Lb. to Large Buyers:*	Cents	Cents	Cents	Cents
Lake copper, New York	13.87½	13.87½	13.75	13.75
Electrolytic copper, N. Y.	13.62½	13.62½	13.50	12.75
Zinc, St. Louis	4.82½	4.82½	4.87½	5.60
Zinc, New York	5.17½	5.17½	5.37½	6.10
Lead, St. Louis	**4.40**	4.37½	4.45	4.75
Lead, New York	4.70	4.70	4.70	4.75
Tin, New York	32.75	32.75	31.75	36.00
Antimony (Asiatic), N. Y.	4.50	4.50	4.50	5.20

The prices in the above table are for domestic delivery and do not necessarily apply to export business.

Composite Price, Jan. 3, 1922, Finished Steel, 2.062c. Per Lb.

Based on prices of steel bars, beams, tank plates, plain wire, open-hearth rails, black pipe and black sheets — These products constitute 88 per cent of the United States output of finished steel.

Dec. 27, 1921,	2.062c.
Dec. 6, 1921,	2.135c.
Jan. 4, 1921,	3.057c.
10-year pre-war average,	1.684c.

Composite Price, Jan. 3, 1922, Pig Iron, $18.60 Per Gross Ton

Based on average of basic and foundry irons, the basic being Valley quotation, the foundry an average of Chicago, Philadelphia and Birmingham

Dec. 27, 1921,	$18.68
Dec. 6, 1921,	19.47
Jan. 4, 1921,	31.97
10-year pre-war average,	15.72

tions of steel plants in this and nearby districts, following the holiday interruption. Prices do not change much, but if there is a definite tendency, it is in favor of buyers. No shading of sheet prices yet has developed, but there still is considerable uncertainty as to prices of most of the other finished products. This is particularly true of the heavier lines, although a report that the Steel Corporation soon would announce lower prices of plates, shapes and bars is strongly denied. The Dec. 15 reduction in steel pipe prices is reported to have frightened buyers to some extent, and fear also is expressed as to the effect of a reduction of 50c. per barrel in the price of Pennsylvania crude oil upon the immediate demand for oil country goods. Manufacturers of wire products, in contradiction to reports, said to have emanated from purchasing agencies, declare that the Dec. 21 prices are not being shaded.

The pig iron market shows very little life and light steel plant and foundry operations find full reflection in the demand for scrap iron and steel. The coke market has been enlivened by the consummation of a number of contracts for furnace coke for January, first quarter and first half delivery. About 300,000 tons are involved, a feature of the business being that almost half will be supplied from by-product grade.

Pig Iron.—Both inquiries and sales have been few and small in the past week. Sales of more than a carload are unusual and producers find difficulty in interesting melters in their future requirements, even by giving intimations of a willingness to accept concessions from current quotations. Follansbee Brothers Co. again is seeking 1000 tons of basic, but this company is able to get iron at a source near its plant for so much less than prices quoted by western Pennsylvania and Valley furnace interests that the latter have little chance to secure the business. Such lots of foundry iron as have lately been moved have been at $19.50 to $20, Valley furnace, for No. 2 grade. There has been no business to support a change in basic iron from $18.25, Valley furnace, and Bessemer still is quoted at $20, although this price would be shaded as much as 50c. per ton on an order involving a round tonnage. Malleable iron still is held by some makers at $20, but the best bid recently made has been $19.50. Sales of iron from Valley furnaces for December, as compiled by W. P. Snyder & Co., Pittsburgh, show $18.6875

for basic and $20 for Bessemer, as compared with $19 and $20, respectively, in November.

We quote Valley furnace, the freight rate for delivery to the Cleveland or Pittsburgh district being $1.96 per gross ton:

Basic	$18.25
Bessemer	20.00
Gray forge	$19.00 to 19.50
No. 2 foundry	19.50 to 20.00
No. 3 foundry	19.00 to 19.50
Malleable	19.50 to 20.00

Ferroalloys.—Small lot sales for early delivery are fairly common in ferromanganese and 50 per cent ferrosilicon, but as a general rule at prices which are nearer buyers' than sellers' valuations. The quotation of the local producer of ferromanganese still is $60, Pittsburgh, but it is reported that on some recent transactions a price as low as $59, Pittsburgh, has been accepted. This interest is rather more aggressive for business than it was a short time ago, the explanation being that it has some high-priced ores which it is anxious to liquidate. Meanwhile, other domestic makers are holding to $58.35, Atlantic seaboard, for 78 to 82 per cent material, this price also being quoted for the same grade of material by English producers. That price, however, means a delivered cost at Pittsburgh common freight points, well above that of the local producer, who naturally is getting the bulk of the business. Most of the recent business in 50 per cent ferrosilicon has been supplied from a tonnage sold to middlemen some time ago by a Niagara Falls maker at low prices. As low as $54, delivered, has been done on some of this material and this makes it difficult for makers seeking higher prices to secure orders. It is believed, however, that most of this tonnage now has passed into consumers' hands and there are expectations of a firmer market before long. A central Ohio steel company recently inquired for 300 tons of 16 to 19 per cent spiegeleisen, bids against which ranged from $28.50 to $32, delivered. Practically no 20 per cent spiegeleisen now is available, as there has been little production during the year by commercial producers, and stocks have been pretty well liquidated.

We quote 78 to 82 per cent domestic ferromanganese at $59 to $63.67 delivered; 78 to 82 per cent foreign ferromanganese, $58.35, c.i.f. Atlantic seaboard; German, for 76 to 80 per cent, $54, seaboard. Average 20 per cent spiegeleisen at $30 delivered, Pittsburgh or Valleys; 16 to 18 per cent spiegeleisen, $26 to $30 delivered Pittsburgh; 50 per cent ferrosilicon, domestic, $54 to $57, freight allowed. Bessemer ferrosilicon is quoted f.o.b. Jackson and New Straitsville, Ohio, furnaces as follows: 10 per cent, $38.50; 11 per cent, $41.80; 12 per cent, $45.10; 13 per cent, $49.10; 14 per cent, $54.10; silvery iron, 6 per cent, $27; 7 per cent, $28; 8 per cent, $29.50; 9 per cent, $31.50; 10 per cent, $33.50; 11 per cent, $36; 12 per cent, $38.50. The present freight rate from Jackson and New Straitsville, Ohio, into the Pittsburgh district is $4.06 per gross ton.

Billets, Sheet Bars and Slabs.—Interest in the market is low and with sales few and small quotations largely are appraisals of what might be done. It is patent that $29 is as high as can be done on 4-in. billets, and that if a fair-sized tonnage was offered, it could be placed at $28. On sheet bars and slabs, makers are asking $30, but $29 is more representative of to-day's possibilities.

We quote 4 x 4 in. soft Bessemer and open-hearth billets at $29 to $30; 2 x 2 in. billets, $29 to $30; Bessemer and open-hearth sheet bars, $30; slabs, $29 to $30; forging billets, ordinary carbons, $32 to $33, all f.o.b. Youngstown or Pittsburgh mills.

Nuts and Bolts.—Makers here have experienced no appreciable increase in business, and the common expectation is that trading will continue irregular and unsatisfactory until the year has further progressed and fundamental conditions have been corrected to a point where buyers will feel safe in anticipating their needs. That stocks are light in second hands is evident from the fact that there is considerable eagerness on the part of buyers to secure prompt shipments. There is somewhat better observance of quoted discounts than was the case recently. Discounts are given on page 128. Instead of arbitrary and individual extras for oversize tapping of nuts, a majority of makers now are quoting 2c. per lb. extra for tapping 1/32-in. outside of United States standards for hot pressed and cold punched, in sizes 9/16-in. and smaller and 1c. per lb. extra for sizes ⅝-in. and larger.

Wire Rods.—Some makers are experiencing a fairly good business in small lots with some export sales included in recent transactions. The public quotation still is $38 for the base size of soft rods, but it is admitted that this price is largely a negotiation quotation and that actual sales have been done at $1 to $2 per ton less. Prices are given on page 128.

Structural Material.—The past week has been featured by at least two good-sized awards, these being the new rod and wire plant of the Wheeling Steel Corporation at Portsmouth, Ohio, taking 3000 tons, and several mill buildings and crane runways for the Steubenville, Ohio, works of the same company, involving 2000 tons. Both orders went to the McClintic-Marshall Co., which also has taken the contract for an extension to the refinery building and the new calcining building for the International Nickel Co., Huntington, W. Va., the two jobs taking 500 tons. This company also will fabricate steel for North Pier No. 3 for the Frederick Snare Corporation, New York, taking 175 tons; a 5-story storage building at Harrisburg placed through the Hughes-Foulkrod Co., Pittsburgh, requiring 285 tons; and a 7-span bridge for the Chicago, Burlington & Quincy Railway Co., Chicago, taking 325 tons. The market on plain material holds fairly steady with the bulk of the business moving at 1.50c. Prices are given on page 128.

Spikes and Track Bolts.—Demands still are few and small and prices rather unsteady. Large spikes are quoted at $2.25 base per 100-lb., but there has been some recent business as low as $2.20 and like concessions are appearing in small spikes, on which the regular or public quotation is $2.40 base per 100-lb. Track bolts have eased off about $5 per ton with carload lots available at from $3.25 base per 100 lb. and even as low as $3. Prices are given on page 128.

Plates.—The market here is extremely narrow, for the reason that consumers being served from other centers have something of an advantage on local tank builders and fabricating interests, in the matter of delivered prices. It is claimed that some business is being taken at 1.60c., but the more common price is 1.50c., on other than retail quantities.

We quote sheared plates, ¼ in. and heavier, tank quality, at 1.50c. f.o.b. Pittsburgh.

Cold-Finished Steel Bars and Shafting.—There is no special change in the general situation, buyers still being inclined to order sparingly and then only for supplies to round out depleted lines. It is believed that stocks in consumers' hands are pretty well liquidated, and that if there are no really large orders in the near future, at least demands will be more numerous than they have been in the past 60 to 90 days. Prices take an unusually wide range. On what are regarded as desirable tonnages, as low as 1.90c., and even 1.85c., has been done, but on the bulk of such business as has come out 2c. is minimum and some business actually has been entered as high as 2.25c. where the order has been rather difficult of execution. Ground shafting is unchanged at $2.50 base per 100-lb. f.o.b. mill.

Steel Skelp.—The market is inactive but fairly steady at 1.50c. There is a little export business, but this is not especially desirable since it means taking less than 1.50c.

Iron and Steel Bars.—The market on steel bars has pretty definitely settled to 1.50c., Pittsburgh, although the claim is made that 1.60c. prevails on some business.. Demand is for small lots for immediate delivery. Activity also is lacking in iron bars, which are quotable on sales at 2c. to 2.10c., although the asking price of most makers is 2.15c., base.

We quote steel bars rolled from billets at 1.50c.; reinforcing bars, rolled from billets, 1.45c. to 1.50c. base; reinforcing bars, rolled from old rails, 1.40c. to 1.45c.; refined iron bars, 2c. to 2.10c. in carloads, f.o.b. mill, Pittsburgh.

Rivets.—Demand still is entirely hand-to-mouth and there is little indication of an early departure from this policy. Makers insist that present prices more than discount the decline in rods and bars, but in spite of that fact there is more or less shading of quotations chiefly by those not recognized as regular makers of rivets. Companies making a full line of rivets are quoting $2.40 base per 100-lb. for large structural and ship rivets and $2.50 per 100-lb. for large boiler rivets. Competition, however, has resulted in prices from $3 to $5 per ton below those figures. Prices and discounts are given on page 128.

Coke and Coal.—The last week of the old year saw the conclusion of negotiations for furnace coke contracts involving a total tonnage of approximately 300,000. The Sharon Steel Hoop Co., Sharon, Pa., which has been operating its furnace at Lowellville, Ohio, for the past six months on by-product coke, for the next six months, will use beehive oven fuel; this contract is for six months and calls for a total of about 70,000 tons. The coke for the new Trumbull-Cliffs furnace, Warren, Ohio, which goes into blast Jan. 15, will be supplied by the Youngstown Sheet & Tube Co., the contract to run from Jan. 15, to July 1, and to involve 90,000 tons. The Youngstown Sheet & Tube Co. also has taken the contract for 10,000 tons a month for the first three months of the year for the Shenango Furnace Co., Sharpsville, Pa., and will furnish 14,000 tons a month for February and March, for the furnace of the A. M. Byers Co., Girard, Ohio. A Connellsville district producer, now supplying the Adrian furnace, DuBois, Pa., will continue to supply the requirements of that furnace for the first three months of this year, which amount to 9000 tons a month. The Colonial Iron Co., Riddlesburg, Pa., has closed for the first quarter with a Connellsville producer, this contract calling for 8000 tons a month. Several contracts for January shipment also have been closed, one of these being for 10,000 tons and another for 6000 for Eastern furnaces. The business has definitely established the contract market on first quarter tonnages of beehive oven furnace fuel at from $3 to $3.25 per net ton ovens, or 25c. per ton below what producers asked at the outset of negotiations a few weeks ago. Spot foundry coke is quotable about $1 per ton above furnace grade.

Iron and Steel Pipe.—Slowing down in the demand incident to the end of the year seems to have been accentuated by the most recent reduction in prices, and since to-day brought the announcement of a reduction of 50c. per barrel in the price of Pennsylvania crude oil, the first reaction since the market turned upward several months ago, there is some apprehension about early orders for oil country goods. Most makers have accumulated a fair amount of business, however, and mill operations still are relatively high. Discounts are given on page 128.

Hoops and Bands.—Activities still are limited, probably because of the uncertainties which exist as to prices. The common quotation on hoops is 2c., base Pittsburgh, and so far the effort to obtain a lower price has not been successful, although the contention of buyers that a spread of $10 per ton between the present base prices of steel bars and hoops is too wide is not disputed. The asking price on bands also is 2c., but business at this price has been difficult to obtain, because buyers claim to have quotations as low as 1.75c. If such quotation has been made, it is believed to have come from manufacturers having bar mills and who have based the price on bars plus the old card differential of 25c. per 100 lb. for bands.

Hot-Rolled and Cold-Rolled Strips.—Effective Jan. 1, the American Steel & Wire Co. named a price of 3.50c., base Pittsburgh, for cold-rolled strips, and this price is being met by independents, although a few still are asking 3.75c. There is no change in hot-rolled strips, which still are quoted anywhere from 2c. for the more desirable tonnages, up to 2.25c. for those more difficult of execution.

Wire Products.—Widespread circulation of reports that the Dec. 21 prices were not being strictly adhered to and that concessions of 10c. to 15c. per keg were being made to large buyers of nails, although stoutly denied by leading manufacturers, have tended to intensify the dullness usual to this time of year. Important manufacturers here insist that there has been no shading of the $2.50 base per keg for bright nails nor $2.25 base per 100 lb. for plain wire.

We quote wire nails at $2.50 base per keg, Pittsburgh, and bright basic and Bessemer wire at $2.25 base per 100 lb., Pittsburgh.

Steel Rails.—Demand for light rails is extremely limited, as usual at this time of the year. Demands from contractors are small and the coal companies seem to have long since provided against their winter requirements. These rails rolled from new steel commonly are quoted at 1.60c., but this price is being obtained only for small lots and a price of 1.55c. is not hard to obtain. Practically all orders for standard rails call for delivery during first six months. Ordinarily contracts run for the full year. Evidently the railroads are expecting further price concessions.

We quote 25 to 45-lb. sections, rolled from new steel, 1.55c. to 1.60c. base; rolled from old rails, 1.50c. base; standard rails, $40 per gross ton mill for Bessemer and open-hearth sections.

Tin Plate.—New orders continue few, but container manufacturers are specifying freely and shipments are showing up unusually well for this time of the year. The situation in canned foods is much more favorable than it was at the beginning of 1921, for in contrast with that time stocks are reported to be very light in distributors' hands. The packers have rather big stocks, but their position in this respect is better than it was a few months ago. There is good observance of the regular quotation of $4.75 per base box on standard coke tin plate. On export business prices are somewhat firmer than they were a short time ago, due to the fact that competition from Welsh makers is not as sharp as it has been.

We quote standard production coke tin plate at $4.75 per base box f.o.b. Pittsburgh for carload lots.

Sheets.—Independent mill operations are low again this week, as a number which shut down for the holidays have not yet accumulated enough business to start up. The American Sheet & Tin Plate Co. is running about 65 per cent, largely because of the receipt of some rather sizable orders for light gage sheets for shipment to Japan. Prices are given on page 128.

Old Material.—The market is inactive as far as purchases by melters are concerned, but maintains a very firm tone because of light available supplies and the expectation that before the month ends there will be an increase in steel works operations and consequently in consumption. Already some dealers have received releases against suspended shipments and during the past few days several of the steel companies have been feeling the market out. Heavy melting steel cannot be bought for less than $14.50, delivered, and sales at that price usually refer to single carloads which the owners are obliged to move promptly. On round tonnages, $15 is the real minimum, and stocks in dealers' yards are not available at less than $16. The market is dull and nominal on foundry grades and on those kinds of material going to special uses. The Baltimore & Ohio Railroad will receive bids until noon, Jan. 9, for 17 cars and 9660 gross tons of scrap; also for 300 lb. of high speed steel. The Pennsylvania Railroad, Central Region, list, on which bids will close Jan. 5, offers 12,862 net tons and the Eastern Region list, bids on which close to-morrow, offers approximately 20,000 net tons, including 5000 tons of rails.

We quote for delivery to consumers' mills in the Pittsburgh and other districts taking the Pittsburgh freight rate, as follows:

Heavy melting steel, Steubenville, Follansbee, Brackenridge, Monessen, Midland and Pittsburgh	$14.50 to $15.00
No. 1 cast, cupola size	16.25 to 16.75
Rerolling rails, Newark and Cambridge, Ohio; Cumberland, Md.; Huntington, W. Va., and Franklin, Pa.	15.50 to 16.00
Compressed sheet steel	12.00 to 12.50
Bundled sheets, sides and ends	10.50 to 11.00
Railroad knuckles and couplers	15.00 to 15.50
Railroad coil and leaf springs	15.00 to 15.50
Low phosphorus standard bloom and billet ends	18.00 to 18.50
Low phosphorus plates and other grades	17.00 to 17.50
Railroad malleable	13.00 to 13.50
Iron car axles	24.00 to 25.00
Locomotive axles, steel	22.00 to 23.00
Steel car axles	15.50 to 16.00
Cast iron wheels	15.00 to 15.50
Rolled steel wheels	15.00 to 15.50
Machine shop turnings	9.00 to 9.50
Sheet bar crop ends	14.50 to 15.00
Heavy steel axle turnings	11.00 to 11.50
Short shoveling turnings	10.00 to 10.50
Heavy breakable cast	14.00 to 14.50
Stove plate	13.00 to 13.50
Cast iron borings	10.00 to 10.50
No. 1 railroad wrought	11.50 to 12.00

Chicago

CHICAGO, Jan. 3.

December bookings of an important local mill were larger than those of any month since April. Much of the tonnage taken was traceable directly or indirectly to the railroads and oil fields. Considerable additional business is expected from the same sources, as both car builders and tank fabricators are figuring on large inquiries which are expected to be closed soon. A number of rail orders also will probably be placed soon, although it is notable that rail buying is not on the scale of a year ago. Business from miscellaneous sources which was exceptionally light during the last month of 1921 is also expected to revive, now that inventory taking is out of the way, as stocks of jobbers and manufacturers alike are generally low. Public improvements and private building projects which have been held in abeyance are expected to go ahead in view of the favorable terms under which money can now be borrowed for legitimate enterprise. In a word, producers look forward hopefully in the new year, and while they recognize the fact that cautious buying will probably continue the rule until freight rates are reduced and coal miners wages are adjusted, they believe that a slow, but steady, improvement in business is in store for the industry during the coming quarter.

Owing to the fact that much of the tonnage it has recently booked called for deferred delivery, the Illinois Steel Co.'s operations have declined, its steel output being on a 35 per cent basis. The Inland Steel Co., after having shut down a number of mills during the holidays, has resumed operations on a 50 per cent basis. The operations of other mills are irregular.

Pig Iron.—The market was quiet between the holidays and among the few sales made may be mentioned 350 tons of foundry for January shipment to a Michigan point, 200 tons of malleable for first quarter delivery to a local melter, and 125 tons of foundry to a western Illinois consumer for January shipment. The price situation is unchanged. Although a steel works furnace, which is booked ahead through January, refuses to quote lower than $20, base, on foundry, malleable and basic, iron is available from the leading merchant and other sources at $19 to $19.50, base furnace. The Auto Specialties Co., Benton Harbor, Mich., is inquiring for 2000 tons of malleable for second quarter delivery. A Wisconsin melter wants 500 tons of malleable for first quarter delivery. Some resale iron has been disposed of recently and it is reported that a fair quantity is still on the market. No sales of Southern iron are reported, but $17, base Birmingham, is freely quoted and is intimated that $16.50 might be done. We note a sale of a carload of charcoal to a local melter and of another carload for export both at $28, base furnace.

Quotations on Northern foundry, high phosphorus malleable and basic irons are f.o.b. local furnace and do not include a switching charge averaging 70c. per ton. Other prices are for iron delivered at consumers' yards, or when so indicated, f.o.b. furnace other than local.

Lake Superior charcoal, averaging sil. 1.50, delivered at Chicago	$31.50
Northern coke, No. 1, sil. 2.25 to 2.75	$19.50 to 20.00
Northern coke, foundry, No. 2, sil. 1.75 to 2.25	19.00 to 19.50
Northern high phos	19.00 to 19.50
Southern foundry, sil. 1.75 to 2.25	23.67
Malleable, not over 2.25 sil	19.00 to 19.50
Basic	19.00 to 19.50
Low phos., Valley furnace, sil. 1 to 2 per cent copper free	33.00
Silvery, sil. 8 per cent	32.82 to 34.82

Ferroalloys.—We note inquiries for one carload each of ferromanganese, spiegeleisen 50 per cent and ferrosilicon from local melters. Otherwise the market is without features.

We quote 78 to 82 per cent ferromanganese, $66.75, delivered; 50 per cent ferrosilicon, $60, delivered; spiegeleisen, 18 to 22 per cent, $36 to $37, delivered.

Rails and Track Supplies.—Within the past week the Gary mill has booked a number of rail orders from local roads aggregating 30,000 tons. The Louisville & Nashville has placed 50,000 tons with the Tennessee company. There is little inquiry for track accessories and few orders for light rails are being booked. Light rails rolled from new billet stock are available at from 1.60c. to 1.65c., f.o.b. mill, while rerolled rails can be bought as low as 1.50c. mill.

Standard Bessemer and open-hearth rails, $40; light rails rolled from new steel, 1.60c. to 1.65c. f.o.b. makers' mills.

Standard railroad spikes, 2.15c. to 2.25c., Pittsburgh; track bolts with square nuts, 3.20c. to 3.25c., Pittsburgh; tie plates, steel and iron, 1.875c. to 2c., f.o.b. mill; angle bars, 2.40c., f.o.b. mill.

Railroad Equipment.—The John Morrell Co., packer, Ottumwa, Iowa, has ordered 100 refrigerator cars from the American Car & Foundry Co. The Seaboard Air Line has bought 25 locomotives from the American Locomotive Co., and is reported to have placed 2500 freight cars of various types with the Chickasaw Ship Building & Car Co. The Delaware, Lackawanna & Western is inquiring for five locomotives. The Burlington is expected to close for 7300 freight cars this week and the Illinois Central will take early action on 2200 cars, of which 1500 gondolas are for its own lines and 500 box and 200 gondola cars for its subsidiary, the Central of Georgia. The Great Northern is inquiring for 20 passenger cars. The Great Northern will not take action on its inquiry for freight cars until after Jan. 10. The Union Pacific, which recently put out inquiries for 1500 freight cars, has increased the total to 5500 cars.

Bars.—Outside of encouraging tonnages coming from car builders, little new business in mild steel bars is developing. With inventory taking out of the way, however, jobbers and miscellaneous manufacturers are expected to enter the market to replenish their stocks. The price situation shows no material change. In the reinforcing field few new lettings are reported, although considerable work is in prospect. For a tuberculosis sanitorium for disabled volunteer soldiers at Milwaukee 500 tons are reported to have been awarded to the C. A. P. Turner Co. A local rail carbon steel bar mill will furnish 150 tons for the J. L. Taylor Building, Chicago. On Jan. 13, bids will be taken on the general contract for aeration and sedimentation tanks at the Jones Island sewage disposal plant, Milwaukee. About 5000 tons of reinforcing is involved. Bar iron demand is still of a spasmodic character, and mill operations are irregular. One local mill is now idle, while another has been operating for three weeks and still has another week's work ahead. The price situation is on about the same basis as a week ago, although quotations of 1.60c., Chicago, are commoner than 1.65c. Demand for hard steel bars is so light that it is difficult to ascertain what the ruling market price is.

Mill prices are: Mild steel bars, 1.60c. to 1.75c., Chicago; common bar iron, 1.60c. to 1.65c., Chicago; rail carbon, 1.65c., mill or Chicago.

Jobbers quote 2.68c. for steel bars out of warehouse. The warehouse quotation on cold-rolled steel bars and shafting is 3.55c. for rounds and 4.05c. for flats, squares and hexagons. Jobbers quote hard and medium deformed steel bars at 2.38c. base. Hoops and bands, 3.28c.

Wire Products.—Demand was very light during the last week of 1921, but with inventory taking out of the way, buyers are now expected to come into the market for their needs. The stocks of users, and particularly jobbers, are low and buying for replenishment purposes is looked for. A number of fair-sized inquiries for wire rods have been received from wire mills, and it is said that as low as $37 has been quoted. For mill prices, see finished iron and steel, f.o.b. Pittsburgh, page 128.

We quote warehouse prices f.o.b. Chicago: No. 9 and heavier black annealed wire, $3.13 per 100 lb.; No. 9 and heavier bright basic wire, $3.28 per 100 lb.; common wire nails, $3.25 per 100 lb.; cement coated nails, $2.65 per keg.

The mill quotation on plain material ranges from 1.60c. to 1.75c., Chicago. Jobbers quote 2.78c. for materials out of warehouse.

Bolts and Nuts.—The market is still quiet and weak, but some replenishment buying is expected during the coming month. For mill prices, see finished iron and steel, f.o.b. Pittsburgh, page 128.

Jobbers quote structural rivets, 3.43c.; boiler rivets, 3.53c.; machine bolts up to ⅞ x 4 in., 60, 10 and 10 per cent off; larger sizes, 60 and 10 off; carriage bolts up to ⅞ x 6 in., 60 and 10 off; larger sizes, 55 and 5 off; hot pressed nuts, square and hexagon tapped, $3.75 off; blank nuts, $4 off; coach or lag screws, gimlet points, square heads, 65 and 5 per cent off. Quantity extras are unchanged.

Sheets.—Demand is thinning out and it is apparent that buyers are waiting for some weakness to develop in present prices, which are very firm. Mills, however, take the position that inasmuch as sheets are in constant use and consumers' stocks are scraping bottom, it is only a question of time when buyers will be forced to re-enter the market for their requirements.

Mill quotations are 3c. for No. 28 black, 2.25c. for No. 10 blue annealed and 4c. for No. 28 galvanized, all being Pittsburgh prices, subject to a freight rate to Chicago of 38c. per 100 lb.

Jobbers quote: Chicago delivery out of stocks, No. 10 blue annealed, 3.38c.; No. 28 black, 4.15c.; No. 28 galvanized, 5.15c.

Structural Material.—Numerous public improvements as well as other building projects are expected to go ahead this year not only because construction costs have declined materially during the past 12 months, but also because funds for legitimate enterprise are now easily obtainable at reasonable rates. It is also to be noted that railroad construction work is expanding. Out of 29 inquiries recently received by a local fabricator, 16 were from railroads. While much of this railroad work is small, some of it runs into fair tonnages. Recent lettings include:

Blum Building addition, Chicago, 613 tons, to Vanderkloot Iron Works.

Black River bridge, Black River Falls, Wis., 305 tons, to Worden-Allen Co.

Minnesota State bridges Nos. 3660 and 3661, New Ulm, 249 tons, to Illinois Steel Bridge Co.

Huasno and Alamo Creek bridges, San Luis Obispo County, Cal., 219 tons, to Minneapolis Steel & Machinery Co.

Marquette Portland Cement Co., main shop and office building, La Salle, Ill., 350 tons, to Worden-Allen Co.

Wisconsin Highway Commission, 180-ft. span, Tomahawk, Wis., 100 tons, to Worden-Allen Co.

Chicago, Burlington & Quincy, seven deck plate girder spans, 300 tons, to McClintic-Marshall Co.

Chicago, Rock Island & Pacific, seven 90-ft. deck plate girder spans, 570 tons, to American Bridge Co.

Contracts Pending

Cadillac Foundry Co., foundry building, Cadillac, Mich., 301 tons, bids taken by Frank D. Chase, Inc., Chicago.

Pollak Steel Co., South Chicago, Ill., new plant to replace present facilities, about 600 tons.

Great Northern Railroad, bridges, 650 tons.

Cast-Iron Pipe.—Several inquiries have appeared as the new year opens and sellers look for much additional work to come up for bids in the near future. Recent lettings include:

Denver, 343 tons to Colorado Fuel & Iron Co.

Marion, Ind., 76 tons of pipe and fittings to James B. Clow & Sons.

Prospective business includes:

Akron, Ohio, 900 tons, bids in Jan. 6.

Ellis, Kans., 269 tons of 4 and 6-in., Jan. 9.

Woodward, Okla., 80 tons, Jan. 4.

We quote per net ton, f.o.b. Chicago, as follows: Water pipe, 4-in., $47.10 to $48.10; 6-in. and above, $43.10 to $44.10; class A and gas pipe, $4 extra.

Plates.—Local mills booked additional tonnage from carbuilders and tank fabricators during the last week of 1921. While orders for plates, shapes and bars came chiefly from these sources during the closing months of the past year, general demand is expected to revive soon, as consumers are bare of stocks and will be forced to buy material to fill their own orders. On the other hand, it seems assured that tank builders and car shops will continue to require large tonnages of steel. The Pierce Oil Co. is now in the market for storage tanks for the new Mexia (Texas) field, involving from 4000 to 8000 tons of plates. Another new oil field is about to be developed near Denison, Texas, with the probable result that there will again be a demand for large storage facilities.

The outlook in car construction is even more encouraging. Fully 25,000 freight cars are expected to be bought by railroads in this district early in the year. Action on a number of inquiries put out late in 1921 was deferred pending a reduction in the prices of patented car specialties, lower quotations on which are expected to be announced early this month.

The ruling mill quotations range from 1.60c. to 1.75c., Chicago. Jobbers quote 2.78c. for plates out of stock.

Coke.—Local by-product foundry coke has been reduced to $10.75, delivered in the Chicago switching district.

Old Material.—Consumptive buying is at a minimum, but dealers are laying in stocks in anticipation of later demand. These purchases by sellers have tended to strengthen the market somewhat and a few advances are noted below. Railroad offerings include the Baltimore & Ohio, 10,000 tons; the Chicago & North Western, 3300 tons; the Lake Erie & Western, 10 cars; the New York Central and the Michigan Central, blind lists.

We quote delivery in consumers' yards Chicago and vicinity, all freight and transfer charges paid, as follows:

Per Gross Ton	
Iron rails	$16.00 to $16.50
Relaying rails	23.00 to 27.50
Cast iron car wheels	15.50 to 16.00
Rolled or forged steel car wheels	13.00 to 13.50
Steel rails, rerolling	12.50 to 13.00
Steel rails, less than 3 ft.	12.50 to 13.00
Heavy melting steel	11.50 to 12.00
Frogs, switches and guards cut apart	11.50 to 12.00
Shoveling steel	11.00 to 11.50
Low phos. heavy melting steel	13.50 to 14.00
Drop forge flashings	7.50 to 8.00
Hydraulic compressed sheet	7.50 to 8.00
Axle turnings	8.50 to 9.00
Per Net Ton	
Iron angles and splice bars	14.00 to 14.50
Steel angle bars	10.50 to 11.00
Iron arch bars and transoms	15.00 to 15.50
Iron car axles	19.00 to 19.50
Steel car axles	12.50 to 13.00
No. 1 busheling	8.25 to 8.75
No. 2 busheling	6.00 to 6.50
Cut forge	10.25 to 10.75
Pipes and flues	7.00 to 7.50
No. 1 railroad wrought	10.50 to 11.00
No. 2 railroad wrought	10.00 to 10.50
Steel knuckles and couplers	11.50 to 12.00
Coil springs	12.50 to 13.00
No. 1 machinery cast	12.50 to 13.00
No. 1 railroad cast	12.00 to 12.50
Low phos. punchings	11.00 to 11.50
Locomotive tires, smooth	10.00 to 10.50
Machine shop turnings	3.50 to 4.00
Cast borings	5.50 to 6.00
Stove plate	12.00 to 12.50
Grate bars	10.50 to 11.00
Brake shoes	10.50 to 11.00
Railroad malleable	11.50 to 12.00
Agricultural malleable	11.50 to 12.00

Cleveland

CLEVELAND, Jan. 3.

Iron Ore.—Several consumers cut off dock shipments Jan. 1, when the higher rail rates for carrying ore to interior furnaces were restored and the movement from docks is expected to be very light during the next few months. Several additional mines in the Lake Superior district have resumed operations.

We quote delivered lower lake ports: Old range Bessemer, 55 per cent iron, $6.45; Old range non-Bessemer, 51½ per cent iron, $5.70; Mesabi Bessemer, 55 per cent iron, $6.20; Mesabi non-Bessemer, 51½ per cent iron, $5.55.

Pig Iron.—The market was unusually dull during the past week and very little new inquiry is pending. A local interest reports the sale of 1200 tons of foundry iron on the basis of $20, Valley, for shipment from western Pennsylvania to a Pittsburgh district consumer and a Columbus, Ohio, melter purchased 500 tons of malleable iron. One lake furnace sold 1500 tons of foundry iron in small lots during the week. On foundry iron $19 has become the more common price with one or more lake furnaces, but for delivery in the immediate vicinity of the furnace $20 is still the usual quotation. For Cleveland delivery slightly higher prices are still obtainable. A sale of 200 tons by a Cleveland furnace to a local consumer at $20.50 is reported. Sellers look for a more active market during the month. Prices on low phosphorus iron have declined and the sharp cut made by Eastern producers may cause further concessions. A few small lot sales are reported at $33 and $33.50. Southern iron is inactive and is now freely offered at $17, Birmingham.

Quotations below are f.o.b. local furnace for Northern foundry iron, not including a 56c. switching charge. Other quotations are delivered Cleveland, being based on a $1.96 freight rate from Valley points, a $3.36 rate from Jackson and a $6.67 rate from Birmingham:

Basic	$20.21 to $20.71
Northern No. 2 fdy., sil. 1.75 to 2.25	19.00 to 20.00
Southern fdy., sil. 2.25 to 2.75	24.17
Ohio silvery, sil. 8 per cent	32.86
Standard low phos., Valley furnace	33.00

Semi-Finished Steel.—Two or three inquiries for sheet bars in lots of 1000 tons have come out. Common quotations are $30 for sheet bars and $29 for slabs, but the market does not appear firm.

Finished Iron and Steel.—With the start of the New

Year a few consumers are seeking to get under cover with contracts and the trade looks for more activity during the next week or two. Sales during the past week were very light, as was to be expected during the holidays. Among new inquiries is one for 500 tons of spring steel. Prices are holding firm at 1.50c. as a minimum for plates, structural material and steel bars. While less than car lots of plates are being sold at that price, local mills are still taking some orders at 1.60c. to 1.65c., which also appeared to be the ruling prices for boiler plates. Some additional plate tonnage has been placed for the repair of lake boats. The Baltimore & Ohio Railroad has taken bids for bridge work requiring 2000 tons of steel. There is no activity in the local building field, but fabricators look for a fair volume of business early in the year. Hard steel reinforcing bars are inactive, being nominally quoted at 1.50c.

Jobbers quote steel bars, 2.54c.; plates and structural shapes, 2.64c.; No. 9 galvanized wire, 3.25c.; No. 9 annealed wire, 2.75c.; No. 28 black sheets, 3.75c.; No. 28 galvanized sheets, 4.75c.; No. 10 blue annealed sheets, 3.10c.; hoops and bands, 3.14c.; cold-rolled rounds, 3.85c.; flats, squares and hexagons, 4.35c.

Sheets.—Inquiry has improved slightly for lots up to 100 tons, but sales were very light during the week. Regular mill prices are being firmly maintained.

Bolts, Nuts and Rivets.—The leading local maker who has been holding to higher quotations has reduced prices to 2.25c. for structural, 2.35c. for boiler rivets and 70, 10 and 10 per cent off list for small rivets. Bolts and nuts were inactive during the week, but makers look for some revival in business when inventories are completed.

Coke.—There is some car lot demand for foundry coke, sales being mostly at $4 and $4.25 for standard Connellsville make. Foundries are not contracting for first quarter, buying only coke that is needed.

Old Material.—There is some local demand for machine shop turnings from the Bourne-Fuller Co., which will blow in the blast furnace of its Upson Nut plant and has made purchases of this grade at $8.50. This company has a large accumulation of heavy melting steel, so that the starting of its open-hearth plant is not expected to have an important stimulating effect on steel making scrap. As a whole, the market was unusually dull during the week and dealers made little attempt to do business. Prices are firm and unchanged. Dealers look for considerable activity in scrap early this month. Purchases by Ohio mills have been light recently and outside of Cleveland stocks in consumers' yards are reported to be low.

We quote per gross ton, f.o.b. Cleveland, as follows:

Heavy melting steel	$11.50 to $12.00
Steel rails, under 3 ft.	12.50 to 13.00
Steel rails, rerolling	14.00 to 14.50
Iron rails	12.00 to 12.50
Iron car axles	18.00 to 19.00
Low phosphorus melting	13.00 to 13.50
Cast borings	8.60 to 9.00
Machine shop turnings	7.50 to 7.60
Mixed borings and short turnings	8.60 to 9.00
Compressed steel	8.75 to 9.00
Railroad wrought	12.00 to 12.50
Railroad malleable	12.50 to 13.00
Light bundled sheet stampings	6.00 to 7.00
Steel axle turnings	9.00 to 10.00
No. 1 cast	15.00 to 16.00
No. 1 busheling	8.25 to 8.75
Drop forge flashings, over 10 in.	7.50 to 8.00
Drop forge flashings, under 10 in.	7.50 to 8.00
Railroad grate bars	12.75 to 13.00
Stove plate	13.00 to 13.25
Pipes and flues	8.50 to 9.00

Birmingham

BIRMINGHAM, ALA., Jan. 3.

At the close of the year the Birmingham iron market was on a base of $16.50. The immediate cause of lower base was an open offer by a furnace interest of lots of 500 tons and over at that figure for a limited period. This induced competition by other makers and resulted in recession of market to the new base. While some car loads were sold at $17 during the last week of the year, makers as a rule accepted the new base and almost all business was done at $16.50. The tonnage booked was not large, nine of the lower prices having stimulated buying. At the same time makers have come to the new year feeling that it is to be better than last. Thirteen blast furnaces were active in Alabama, Jan. 1 compared with five, July 1. Of the active, Jan. 1, seven were on merchant iron, four on basic and two on charcoal.

We quote per gross ton f.o.b. Birmingham district furnaces as follows:

Foundry, silicon 1.75 to 2.25	$16.50
Basic	16.00
Charcoal, warm blast	32.00

Old Material.—Scrap dealers look for better business shortly, but it has not opened up yet. Prices quoted are nominal.

We quote per gross ton f.o.b. Birmingham district yards as follows:

Steel rails	$11.00 to $12.00
No. 1 steel	10.00 to 11.00
No. 1 cast	14.00 to 15.00
Car wheels	13.00 to 14.00
Tramcar wheels	12.00 to 13.00
No. 1 wrought	12.00 to 13.00
Stove plate	11.00 to 12.00
Cast iron borings	6.00 to 7.00
Machine shop turnings	6.00 to 7.00

Buffalo

BUFFALO, Jan. 3.

Pig Iron.—Three furnaces participated in the most recent purchase of the American Radiator Co. when 4400 tons was bought. One interest did not seek the business because of price and shipping conditions and only one furnace of four which bid, did not get any part of the order. While the market on the usual run of business remains firm at $20 base, it is generally assumed that the radiator tonnage sold at less than this figure. Differentials enter into a transaction only when a very high silicon is required. Inquiry is scattered and in the week ending Dec. 31, 25 requests for prices involved a total of 5000 tons. One inquiry for 1700 tons for January and February delivery and another for 800 tons for January delivery, both within the district, are engaging one furnace. Quotations of $19 to New England points frequently made in December and the latter part of November have not been offered within the week and the general tendency is to maintain the $20 level.

We quote f.o.b. per gross ton Buffalo as follows:

No. 1 foundry, 2.75 to 3.25 sil.	$20.00 to $21.00
No. 2X foundry, 2.25 to 2.75 sil.	19.50 to 20.50
No. 2 plain, 1.75 to 2.25 sil.	19.00 to 20.00
Basic	20.00 to 21.00
Malleable	20.00 to 21.00
Lake Superior charcoal	31.75

Warehouse Business.—Some desirable orders have appeared and the confidence in 1922 business is already reflected to a slight degree. Quick delivery is a requirement on this new business.

We quote warehouse prices f.o.b. Buffalo as follows: Structural shapes, 2.80c.; plates, 2.80c.; plates, No. 8 gage, 3.50c.; soft steel bars and shapes, 2.70c.; hoops and bands, 3.30c.; blue annealed sheets, No. 10, 3.55c.; galvanized steel sheets, No. 28, 5.25c.; black sheets, No. 28, 4.25c.; cold-rolled strip steel, 5.90c.; cold-rolled round shafting, 3.80c.

Finished Iron and Steel.—Improved tone in all lines is found and particularly good orders for immediate shipment have been received in tin plate and wire products. Toward the end of the week which closed Dec. 31, more than the average run of carload business in bars and plates developed. The Buffalo Steel Car Co. bought 250 tons of plates from a Buffalo interest and the price is understood to have been less than 1.50c. Another Buffalo interest is inquiring for 150 tons of sheets—the largest local inquiry of this kind in some time.

Coke.—Prices have weakened through the disinterest of buyers and best grades now can be obtained at $4 ovens.

Old Material.—Inquiries from outside the district for heavy melting steel, hydraulic compressed and turnings and borings have failed to develop quotations from dealers here.

We quote dealers' asking prices per gross ton f.o.b. Buffalo as follows:

Heavy melting steel	$13.00 to $14.00
Low phos., 0.04 and under	17.00 to 18.00
No. 1 railroad wrought	15.00 to 16.00
Car wheels	16.50 to 17.50
Machine shop turnings	7.50 to 8.00
Cast iron borings	7.00 to 8.00
Heavy axle turnings	10.50 to 11.50
Grate bars	12.00 to 13.00
No. 1 busheling	10.00 to 11.00
Stove plate	15.00 to 16.00
Bundled sheet stampings	8.00 to 9.00
No. 1 machinery cast	17.00 to 18.00
Hydraulic compressed	10.50 to 11.50
Railroad malleable	13.00 to 14.00

Philadelphia

PHILADELPHIA, Jan. 3.

With profound relief the iron and steel trade observed the passing of the old year. It hopes for better things this year, but the first business day of 1922 brought no change in the situation as it has existed in recent weeks. It is, of course, yet too early to foretell what may happen within the next few months, but there continues a degree of optimism that gradual improvement may be expected. Of fresh developments there is none to point the way, the holiday week having been unusually quiet.

Pig Iron.—During the holiday week there was little closing of pig iron business, sales totaling considerably less than in the preceding week. Most of the tonnages were small—under 500 tons. Eastern pig iron makers have stiffened on prices, with the result that a few large inquiries, one particularly of 3000 tons, and another of 2000 tons of foundry grade, have not been closed because the buyers have been unable to obtain the prices that were open to them a week or two ago. No. 2 plain iron now seems firm at a minimum of $20, furnace, with all sellers, with No. 2X 50c. per ton higher. A few small sales of low phosphorus iron have been made at $30 for the copper free and $28 for the copper bearing, with freight rate added.

The following quotations are, with the exception of those on low phosphorus iron, for delivery at Philadelphia, and include freight rates varying from 84 cents to $1.54 per gross ton:

East. Pa. No. 2 plain, 1.75 to 2.25 sil.	$20.84 to $21.26
East. Pa. No. 2X, 2.25 to 2.75 sil.	21.34 to 21.76
Virginia No 2 plain, 1.75 to 2.25 sil.	27.74 to 28.74
Virginia No. 2X, 2.25 to 2.75 sil.	28.24 to 29.74
Basic deliv. eastern Pa.	20.25
Gray forge	21.00 to 22.00
Malleable	23.00 to 24.00
Standard low phos. (f.o.b. furnace)	30.00
Copper bearing low phos. (f.o.b. furnace)	28.00

Ferroalloys.—Eastern makers continue to quote $58.35, seaboard, on standard ferromanganese, which is also the British quotation. One or two small inquiries for spiegeleisen are in the market. The common quotation is $25, furnace, for the 18 to 22 per cent grade.

Billets.—Forging billets have been sold at $32, Pittsburgh. Open-hearth rerolling billets are quite freely quoted at $28, Pittsburgh.

Old Material.—Dullness continues in the scrap market and prices are virtually unchanged. Forge fire is slightly higher. One Eastern steel company, which had been paying $12.50 for steel, now offers only $12. Other sales have been made at $11.50, delivered. We quote for delivery at consumers' works in this district as follows:

No. 1 heavy melting steel	$11.50 to $12.00
Scrap rail	11.50 to 12.00
Steel rails, rerolling	16.25 to 16.75
No. 1 low phos., heavy 0.04 and under	17.00 to 18.00
Car wheels	16.50 to 17.00
No. 1 railroad wrought	14.50 to 15.00
No. 1 yard wrought	12.00 to 12.50
No. 1 forge fire	10.00 to 10.50
Bundled sheets (for steel works)	9.50 to 10.00
No. 1 busheling	12.00 to 13.00
No. 2 busheling	10.00 to 11.00
Turnings (short shoveling grade for blast furnace use)	9.00 to 9.50
Mixed borings and turnings (for blast furnace use)	9.00 to 9.50
Machine-shop turnings (for rolling mill and steel works use)	9.00 to 9.50
Heavy axle turnings (or equivalent)	9.50 to 10.00
Cast borings (for steel works and rolling mills)	11.50 to 12.00
Cast borings (for chemical plants)	13.50 to 14.00
No. 1 cast	16.50 to 17.00
Railroad grate bars	14.00 to 14.50
Stove plate (for steel plant use)	14.00 to 14.50
Railroad malleable	13.50 to 14.00
Wrought iron and soft steel pipes and tubes (new specifications)	11.50 to 12.00
Iron car axles	No market
Steel car axles	17.00 to 18.00

Finished Steel.—Eastern steel mills have done little business within the past week, but are expecting an improving demand within the next few weeks, as many consumers are known to be in need of steel and have been merely postponing purchases until the new year. Jobbers, in particular, are in need of stock. A slightly better demand for plates is reported by one Eastern mill, which has booked several orders for boiler steel. Prices of plates, shapes and bars are nominally held at 1.50c., Pittsburgh, and some Eastern companies say they will not shade these prices. As no business of importance has been completed within the past week the mills have experienced little difficulty in adhering to this schedule.

Warehouse Business.—Prices on steel products out of stock are unchanged and for Philadelphia delivery are as follows:

Soft steel bars and small shapes, 2.65c.; iron bars (except bands), 2.65c.; round edge iron, 2.80c.; round edge steel, iron finish, 1½ x ½ in., 2.95c.; round edge steel planished, 3.70c.; tank steel plates, ¼-in. and heavier, 2.75c.; tank steel plates, 3/16-in., 2.925c.; blue annealed steel sheets, No. 10 gage, 3.50c.; light black sheets, No. 28 gage, 4c.; galvanized sheets, No. 28 gage, 5c.; square twisted and deformed steel bars, 2.65c.; structural shapes, 2.60c.; diamond pattern plates, ¼-in., 4.60c.; 3/16-in., 4.785c.; ¼-in., 4.90c.; spring steel, 4.10c.; round cold-rolled steel, 3.25c.; squares and hexagons, cold-rolled steel, 3.75c.; steel hoops, No. 13 gage and lighter, 3.50c.; steel bands, No. 12 gage to 3/16-in., inclusive, 3.25c.; iron bands, 3.90c.; rails, 2.75c.; tool steel, 8c; Norway iron, 5c.; toe steel, 4.50c.

New York

NEW YORK, Jan. 3.

Pig Iron.—The most satisfactory feature of the market is the insistence of buyers upon prompt delivery, which indicates that there is demand for all the iron that has been bought. Inquiries amounting to several thousand tons are still pending, but no new business of importance has developed and the past week has been a very quiet one.

We quote delivered in the New York district as follows, having added to furnace prices $2.52 freight from eastern Pennsylvania, $5.46 from Buffalo and $6.16 from Virginia:

East. Pa. No. 1 fdy., sil. 2.75 to 3.25	$22.52 to $23.02
East. Pa. No. 2X fdy., sil. 2.25 to 2.75	23.02 to 23.52
East. Pa. No. 2 fdy., sil. 1.75 to 2.25	22.52 to 23.02
Buffalo, sil. 1.75 to 2.25	24.46 to 24.96
No. 2 Virginia, sil. 1.75 to 2.25	27.16 to 28.16

Ferroalloys.—New demand for ferromanganese is confined to carload lots and the inquiries for 500 tons, which have been before the market for the past two weeks, have not yet resulted in orders. Quotations are unchanged. A few carload lots of spiegeleisen have been sold at the prevailing quotation, but this market also is devoid of activity. The manganese ore market lacks life and quotations are nominal. Demand for 50 per cent ferrosilicon is confined to carload lots at prevailing quotations. Following are prevailing quotations:

Ferroalloys

Ferromanganese, domestic, delivered, per ton,	$60.00 to $63.00
Ferromanganese, British, seaboard, per ton	$58.35
Spiegeleisen, 20 per cent, furnace, per ton	$26.00
Ferrosilicon, 50 per cent, delivered, per ton,	$55.00 to $57.00
Ferrotungsten, per lb. of contained metal	40c. to 50c.
Ferrochromium, 6 to 8 per cent carbon, 60 to 70 per cent Cr., per lb. Cr., delivered	11c. to 14c.
Ferrovanadium, per lb. of contained vanadium	$4.50
Ferrocarbontitanium, 15 to 18 per cent., net ton	$200.00
Ferrocarbontitanium, 15 to 18 per cent, 1 ton to carloads, per ton	$220.00
Ferrocarbontitanium, 15 to 18 per cent, less than 1 ton, per ton f.o.b. Niagara Falls, N. Y.	$250.00

Ores

Manganese ore, foreign, per unit, seaboard	20c.
Tungsten ore, per unit, in 60 per cent concentrates	$2.50 up
Chrome ore, 40 to 45 per cent Cr_2O_3, crude, per net ton, Atlantic seaboard	$20.00 to $25.00
Chrome ore, 45 to 50 per cent Cr_2O_3, crude, per net ton, Atlantic seaboard	$30.00
Molybdenum ore, 85 per cent concentrates, per lb. of MoS_2, New York	50c. to 60c.

Finished Iron and Steel.—While leading mills claim that they are not attempting longer to meet the severe competition which has marked recent negotiations, little has occurred to establish any stiffening in prices. Buyers firmly believe, for example, that even a carload lot of plates can be bought on the basis of 1.40c., Pittsburgh. A fair run of business is moving. About 1500 tons of plates have been bought for the locomotives to be built by the American Locomotive Co. for the Central Railroad of New Jersey. An eastern Pennsylvania plate maker will supply 1500 to 1800 tons to a leading oil

company. A California oil company is in the market for a 6-in. oil line, taking 650 tons, and 850 tons for a pipe line for another company has probably been closed at this writing. A round lot of tin plates for three months' needs have been purchased by still another oil company. Among railroads, the New York Central has issued an inquiry for first quarter protection as follows, the understanding being that the amounts named are maximum and are not necessarily those which would actually suffice: 500 tons of billets, 3000 tons bars, shapes and plates, 750 tons nails and staples, 600 tons of black, galvanized and blue annealed sheets, 3000 tires, 25,000 boiler tubes, 5000 car axles and also frogs, switches, crossovers and the like. The Seaboard has placed with the Steel Corporation's Chickasaw car plant a total of probably 2000 cars, and while no other new car business is noted, some negotiation is under way on 4000 cars for the Norfolk & Western. The Erie Railroad has placed a total of 35,000 tons of rails. In structural steel lines the largest new project is a 5000-ton structure for the Bank of America on Wall Street. Awards include 400 tons for a factory at Providence for the Textile Finishing Machine Co.; 1400 tons to the American Bridge Co., for Baltimore & Ohio bridges; 500 tons to the Bethlehem Steel Bridge Corporation, for the Gunpowder River Bridge, and 250 tons to the Phoenix Bridge Co., for a ravine crossing of the Palisades Park highway. No decision has yet been announced respecting 2600 tons for the Philadelphia Museum of Art. The Knickerbocker Ice Co. is inquiring for 700 tons for a storehouse.

We quote for mill shipments, New York, as follows: Soft steel bars, 1.88c.; plates, 1.83c. to 1.88c.; structural shapes, 1.88c.; bar iron, 1.98c. to 2.03c. On export shipments the freight rate is now 28.5c. per 100 lb., instead of 38c., the domestic rate.

Cast-Iron Pipe.—Bids were opened last week for 500 tons for Providence, R. I., the Warren Foundry & Machine Co., Phillipsburg, N. J., being low bidder; also for 700 tons for New Bedford, Mass., the low bidder being R. D. Wood & Co., Philadelphia. In both instances, sizes ranged from 8 to 16 in. Business is dull, but much better than a year ago. We quote per net ton, f.o.b. New York, carload lots, as follows: 6-in. and larger, $47.30; 4-in. and 5-in., $52.30; 3-in., $62.30, with $4 additional for Class A and gas pipe.

Coke.—Effective Jan. 1, the by-product coke plants in New England reduced prices from $10.66 to $10.40, delivered in New England where the freight rates are less than $3.40. This is equivalent to $4.24, Connellsville base.

Old Material.—The market has at least this favorable feature—prices have not declined during the past week, though a drop is expected during the holiday period. Dealers are having many cars rejected because the buyer alleges they do not meet specifications. Then the buyer offers them a dollar or so less and because of the high cost of moving dealers accept his offer. This means that New York dealers have disposed of heavy melting steel at as low as $6, New York.

Buying prices per gross ton, New York, follow:

Heavy melting steel, yard	$8.00 to $8.50
Steel rails, short lengths, or equivalent	8.50 to 9.00
Rerolling rails	9.50 to 10.00
Relaying rails, nominal	28.00 to 30.00
Steel car axles	10.00 to 10.50
Iron car axles	18.50 to 19.00
No. 1 railroad wrought	10.50 to 11.00
Wrought iron track	8.50 to 9.00
Forge fire	5.00 to 5.50
No. 1 yard wrought, long	9.00 to 9.50
Cast borings (clean)	6.50 to 7.00
Machine-shop turnings	4.00 to 5.00
Mixed borings and turnings	4.00 to 4.50
Iron and steel pipe (1 in. diam. not under 2 ft. long)	6.75 to 7.25
Stove plate	9.00 to 10.00
Locomotive grate bars	9.00 to 10.00
Malleable cast (railroad)	8.00 to 8.50
Car wheels	10.50 to 11.50

Prices which dealers in New York and Brooklyn are quoting to local foundries, per gross ton, follow:

No. 1 machinery cast	$16.50 to $17.00
No. 1 heavy cast (columns, building materials, etc.), cupola size	15.50 to 16.00
No. 1 heavy cast, not cupola size	14.00 to 14.50
No. 2 cast (radiators, cast boilers, etc.)	10.00 to 10.50

Warehouse Business.—The market was practically at a standstill during the week from Christmas to New Year's. About the only noticeable activity was in payments of accounts by customers. No price changes were made, but before the end of January there may be a slight revision of quotations on some items. We quote prices on page 140.

High-Speed Steel.—The market was featureless this week. Prices continue nominally at 85c. per lb. to 95c. per lb. for 18 per cent tungsten high-speed steel, with special brands of some producers selling up to $1.05 per lb.

Cincinnati

CINCINNATI, Jan. 3.

Pig Iron.—The market was unusually quiet during the holiday period, and few sales were recorded. The majority of these were for carload lots, and in no instance were more than 100 tons involved. The inquiry is also light, some of those mentioned in last week's report not having been closed. There is some inquiry for ferroalloys, however, one being for 800 tons and one for 500. Prices are inclined to be softer in pig iron, and Southern iron is now definitely established on a $16.50, Birmingham, base, with reports current that even this could be shaded on large tonnages. Some resale Southern iron is reported to have been sold in carload lots at $16.25, but $16.50 more truly represents the market to-day. In the North, $19 to $20 continues as the range, though it is reported that on an inquiry for 300 tons of malleable, one Lake furnace intimated that it would shade $19 to get the order. Chicago furnaces are understood to have adopted $20 as the base, and will not sell for other than January delivery. Nineteen fifty to twenty is still the asking price on southern Ohio irons, depending on location of the furnace competition. Portsmouth and Sarah furnaces were blown in while Jisco silvery stack went out during the week. Union foundries in Cincinnati are closed following the posting of a notice by the employers that, effective Jan. 3, molders' wages would be reduced to $5. Negotiations regarding a wage scale have been going on for some time, and it is likely they will be continued. Union workmen have refused to consent to the reduction and are remaining away from the shops.

Based on freight rates of $4.50 from Birmingham and $2.52 from Ironton, we quote f.o.b. Cincinnati:

Southern coke, sil. 1.75 to 2.25 (base)	$21.00
Southern coke, sil. 2.25 to 2.75 (No. 2 soft)	21.50
Ohio silvery, 8 per cent sil	32.02
Southern Ohio coke, sil. 1.75 to 2.25 (No. 2)	$22.02 to 22.52
Basic, Northern	22.02
Malleable	22.52

Finished Material.—The customary holiday quiet prevailed during the past two weeks in the market for finished material, but strange as it may seem, the orders booked during the month of December by local offices of some steel companies were heavier than for the same month of the past three years. These orders were made up mostly of small lots and included bars, shapes, plates and wire products. During the week, several orders for 200 tons of plates were booked by an independent mill and two lots of structural shapes were also taken by another interest. Prices are inclined to be firmer and 1.50c. is being rigidly held to on current orders for bars, shapes and plates. On wire products $2.50, Pittsburgh, is now the general quotation on nails, and $2.25 per 100 lb. on plain wire. There are few inquiries of size before the trade. The Big Four Railroad will close bids this week on its first quarter requirements for steel, wire, bolts, axles, etc. No tonnage is specified. In the structural field the only new project to come up is the Capitol Theater at Frankfort, Ky., in which 250 tons of steel is involved. Bids will close on Jan. 4. The General Iron Works Co., Cincinnati, will fabricate 250 tons for the Elks Temple in that city. The Sneed Architectural Iron Works will fabricate 190 tons for an addition to the plant of the Standard Sanitary Mfg. Co. at Louisville, Ky., and the Moss Iron Works, Wheeling, has been awarded 125 tons for the Ravenna, Ohio, high school. A small building for the Procter & Gamble Co. at Staten Island, N. Y.,

involving 60 tons has been let to an Eastern fabricator. Bids will close Jan. 3 for an auditorium and market building at Memphis, Tenn., 3500 tons of steel being required. The architects on the 12-story warehouse building for the Belknap Hardware Co., Louisville, Ky., have postponed the opening of bids until Jan. 9. Bids are being taken on both a steel and reinforced concrete building.

Old Material.—There is no activity in the scrap market. Two steel plants operating in this district today notified dealers to suspend shipments till further advised. Locally the scrap market is extremely dull. Some blast furnace scrap was sold during the week for delivery to a southern Ohio furnace which is resuming operations. Prices are unchanged.

We quote dealers' buying prices, f.o.b. cars:

Per Gross Ton	
Bundled sheets	$3.50 to $4.00
Iron rails	12.00 to 12.50
Relaying rails, 50 lb. and up	25.00 to 26.00
Rerolling steel rails	10.50 to 11.00
Heavy melting steel	9.00 to 9.50
Steel rails for melting	9.00 to 9.50
Car wheels	12.00 to 13.00
Per Net Ton	
No. 1 railroad wrought	8.50 to 9.50
Cast borings	3.00 to 3.50
Steel turnings	2.00 to 2.50
Railroad cast	12.00 to 12.50
No. 1 machinery	13.50 to 14.50
Burnt scrap	7.50 to 8.00
Iron axles	15.50 to 16.50
Locomotive tires (smooth inside)	9.50 to 10.00
Pipes and flues	4.00 to 4.50

Boston

BOSTON, Jan. 3.

Pig Iron.—Eastern Pennsylvania furnaces are talking higher prices and are more insistent on silicon differentials, and yet three inquiries for 500 tons each brought out lower prices this week, by at least those furnaces that took the business. In addition, one of these lots sold for second quarter delivery, business furnaces insist they do not want just now. The weakness of these eastern Pennsylvania furnace prices naturally has influenced Buffalo furnace quotations and the market for these two kinds of irons, in the closing days of 1921, were about as weak as at any previous period of the year. Eastern Pennsylvania No. 2 X iron sold this week at $19.50, furnace, or $23.68 delivered, tax paid, and Buffalo No. 2 X on the same delivered basis, tax paid, which brings the price at the furnace down to approximately $18. No sales of Virginia iron are reported and prices are nominal. Business in Alabama iron is confined to an occasional car for mixture purposes, and the market is $1 lower in sympathy with sales made in the South. The most important sales reported this week in the New England territory are 250 tons No. 2 X and 250 tons No. 2 plain, eastern Pennsylvania, first quarter delivery, to a maker of textile machinery; 500 tons No. 2 X eastern Pennsylvania, second quarter delivery, to a Vermont melter; 350 tons eastern Pennsylvania and 300 tons Buffalo No. 1 X, and 150 tons eastern Pennsylvania and 100 tons Buffalo No. 2 X, first quarter delivery, to the Framingham Foundries, Framingham, Mass.; and 150 tons Northern No. 2 X, first quarter delivery, to a Portland, Me., stove maker. One furnace representative reports an inquiry for several thousand tons of iron for first and second quarter delivery, but full details are lacking.

We quote delivered at common New England points as follows, having added to furnace prices $4.06 freight from eastern Pennsylvania, $5.46 from Buffalo, $6.58 from Virginia and $10.66 from Alabama:

East. Penn., silicon 2.25 to 2.75	$24.06 to $25.06
East. Penn., silicon 1.75 to 2.25	23.56 to 24.56
Buffalo, silicon 2.25 to 2.75	24.46 to 25.96
Buffalo, silicon 1.75 to 2.25	24.46 to 25.46
Virginia, silicon 2.25 to 2.75	29.08 to 30.08
Virginia, silicon 1.75 to 2.25	28.58 to 29.58
Alabama, silicon 2.25 to 2.75	28.16
Alabama, silicon 1.75 to 2.25	27.66

Cast Iron Pipe.—The City of New Bedford, Mass., this week opened bids on 705 tons 2 to 12-in. pipe and 14 tons of specials, and the City of Providence, R. I., on 500 tons b and s pipe, made in accordance with Providence specifications. R. D. Wood & Co. were low bidders on the New Bedford lot, there being three other bidders. The actual award will be made within ten days. The Warren Foundry & Machine Co., Phillipsburg, N. H., was lowest of three bidders on the Providence lot. Salem, Mass., has awarded 1085 ft. of pipe and a small list of specials to the Donaldson Iron Co., Emaus, Pa., against three other bidders. The same company is awarded 900 tons of 4 to 12-in. gas pipe, first half delivery, by the Boston Consolidated Gas Co., Boston. Pipe makers are quoting as heretofore, namely, per net ton f.o.b. Boston and district, in carload lots, 3-in., $66.70; 4-in., $56.70; 6-in., $50.70; 10-in. and larger, $49.70, with $4 differentials on class A and gas pipe.

Finished Iron and Steel.—The Boston Structural Steel Co., Inc., Cambridge, Mass., is awarded 440 tons of structural steel for a local hospital addition, 214 tons for a Brookline, Mass., high school, 150 tons for a Lowell, Mass., school, and approximately 100 tons for a Newton, Mass., high school, a total of about 900 tons. Figures will shortly be out for a Kresge store, Boston, and a two-story addition to a large dry goods store, Boston. Plans are being made for a large hotel, Boston, but the steel probably will be placed through New York. Practically no bars were purchased from the mills this week, and plate tonnages booked were unimportant. The market on plates, shapes and bars is generally 1.50c., Pittsburgh. Wire products, especially poultry netting, are in demand, and New England mills are operating at close to capacity.

Jobbers now quote: Soft steel bars, $2.71½ per 100 lb. base; flats, $3.21½; concrete bars, $2.20 to $2.71½; tire steel, $4 to $4.40; spring steel, open hearth, $4.50; crucible, $11.50; steel bands, $3.31½ to $3.78; steel hoops, $3.31½; toe calk steel, $5; cold rolled steel, $3.55 to $4.05; structural steel, $2.71½; plates, $2.81½ to $2.99; No. 10 blue annealed sheets, $3.73; No. 28 black sheets, $4.50; No. 28 galvanized sheets, $5.50; refined iron, $2.71½; best refined, $4.25; Wayne iron, $5.50; Norway iron, $5.50 base.

Old Material—Local old material firms report almost nothing being done in the way of new sales. The little activity noted concerns the filling of contracts placed by Pennsylvania mills some time back. These consumers at the moment show little inclination to cover future requirements, while the daily melt of the average New England foundry is such that requirements can be obtained from local scrap dealers. Market prices, due to the lack of business, naturally have little opportunity to change. They are generally described here as firm, and dealers anticipate securing ruling or higher prices when trading resumes.

The following prices are for gross ton lots delivered consuming points:

No. 1 machinery cast	$18.00 to $19.00
No. 2 machinery cast	16.00 to 17.00
Stove plate	14.50 to 15.00
Railroad malleable	13.50 to 14.00

The following prices are offered per gross ton lots f.o.b. Boston rate shipping points:

No. 1 heavy melting steel	$7.50 to $8.00
No. 1 railroad wrought	11.00 to 11.50
No. 1 yard wrought	9.00 to 9.50
Wrought pipe (1 in. in diameter, over 2 ft. long)	7.00 to 7.50
Machine shop turnings	3.50 to 3.75
Cast iron borings, rolling mill	5.75 to 6.50
Cast iron borings, chemical	7.00 to 7.25
Blast furnace borings and turnings	3.50 to 3.75
Forged scrap and bundled skeleton	4.50 to 5.00
Steel car axles and shafting	11.50 to 12.00
Car wheels	11.00 to 11.50
Rerolling rails	10.00 to 10.50

St. Louis

ST. LOUIS, Jan. 3.

Pig Iron.—The sale for pig iron the last week has been confined largely to carload orders, one order of 200 tons of foundry iron being placed. Inquiries are for carloads mostly, and these were of fair volume. Most of the trade still was waiting for the New Year before placing orders for more than actual requirements. The market on Northern iron may be said to be $19, Chicago, while Southern iron is at $16.50, Birmingham.

We quote delivered consumers' yards, St. Louis, as follows, having added to furnace prices $2.88 freight and war tax from Chicago and $5.91 from Birmingham:

Northern foundry, sil. 1.75 to 2.25	$21.88
Northern malleable, sil. 1.75 to 2.25	21.88
Basic	21.88
Southern foundry, sil. 1.75 to 2.25	22.41

Finished Iron and Steel.—The business from rail-

(*Continued on page* 132)

Prices Finished Iron and Steel, f.o.b. Pittsburgh

Freight Rates

Freight rates from Pittsburgh on finished iron and steel products, in carload lots, to points named, per 100 lb., are as follows:

Philadelphia, domestic	$0.35	Kansas City	$0.815
Philadelphia, export	0.265	Kansas City (pipe)	0.77
Baltimore, domestic	0.335	St. Paul	0.665
Baltimore, export	0.255	Omaha	0.815
New York, domestic	0.38	Omaha (pipe)	0.77
New York, export	0.285	Denver	1.35
Boston, domestic	0.415	Denver (wire products)	1.415
Boston, export	0.285	Pacific Coast	1.665
Buffalo	0.295	Pacific Coast, ship plates	1.335
Cleveland	0.24	Birmingham	0.765
Detroit	0.325	Jacksonville, all rail	0.555
Cincinnati	0.325	Jacksonville, rail and water	0.46
Indianapolis	0.345	New Orleans	0.515
Chicago	0.38		
St. Louis	0.475		

The minimum carload to most of the foregoing points is 36,000 lb. To Denver the minimum loading is 40,000 lb., while to the Pacific Coast on all iron and steel products, except structural material, the minimum is 80,000 lb. On the latter item the rate applies to a minimum of 50,000 lb., and there is an extra charge of 9c. per 100 lb. on carloads of a minimum of 40,000 lb. On shipments of wrought iron and steel pipe to Kansas City, St. Paul, Omaha and Denver the minimum carload is 46,000 lb. On iron and steel items not noted above the rates vary somewhat and are given in detail in the regular railroad tariffs.

Rates from Atlantic Coast ports (i.e., New York, Philadelphia and Baltimore) to Pacific Coast ports of call on most steamship lines, via the Panama Canal, are as follows: Pig iron, 55c.; ship plates, 75c.; ingot and muck bars, structural steel, common wire products, including cut or wire nails, spikes and wire hoops, 75c.; sheets and tin plates, 60c. to 75c.; rods, wire rope, cable and strands, $1; wire fencing, netting and stretcher, 75c.; pipe, not over 8 in. in diameter, 75c.; over 8 in. in diameter, 2½c. per in. or fraction thereof additional. All prices per 100 lb. in carload lots, minimum 40,000 lb.

Structural Material

I-beams, 3 to 15 in.; channels, 3 to 15 in.; angles, 3 to 6 in., on one or both legs, ¼ in. thick and over, and zees, structural sizes, 1.50c.

Sheared plates, ¼ in. and heavier, tank quality, 1.50c.

Wire Products

Wire nails, $2.50 base per keg; galvanized, 1 in. and longer, including large-head barbed roofing nails, taking an advance over this price of $1.25 and shorter than 1 in., $1.75; bright Bessemer and basic wire, $2.25 per 100 lb.; annealed fence wire, Nos. 6 to 9, $2.25; galvanized wire, $2.75; galvanized barbed wire, $3.15; galvanized fence staples, $3.15; painted barbed wire, $2.65; polished fence staples, $2.65; cement-coated nails, per count keg, $2.00; these prices being subject to the usual advances for the smaller trade, all f.o.b. Pittsburgh, freight added to point of delivery, terms 60 days, net, less 2 per cent off for cash in 10 days. Discounts on woven-wire fencing are 68 to 70½ per cent off list for carload lots; 67 to 69½ per cent for 1000-rod lots, and 66 to 68½ per cent for small lots, f.o.b. Pittsburgh.

Bolts and Nuts

Machine bolts, small, rolled threads, 70, 10 and 5 to 70, 10 and 7½ per cent off list
Machine bolts, small, cut threads, 70 and 5 to 70 and 10 per cent off list
Machine bolts, larger and longer, 65, 10 and 5 to 70 and 10 per cent off list
Carriage bolts, ⅜ in. x 6 in.:
Smaller and shorter rolled threads, 65, 10 and 10 per cent off list
Cut threads ..... 65 and 10 to 70 per cent off list
Longer and larger sizes ..... 65 and 10 to 70 per cent off list
Lag bolts ..... 70 and 10 to 70, 10 and 5 per cent off list
Plow bolts, Nos. 1, 2 and 3 heads ..... 60 and 10 per cent off list
Other style heads ..... 20 per cent extra
Machine bolts, c.p.c. and t. nuts, ⅜ in. x 4 in.:
Smaller and shorter ..... 65 and 5 per cent off list
Larger and longer sizes ..... 65 per cent off list
Hot pressed sq. or hex. blank nuts ..... $5.50 off list
Hot pressed nuts, tapped ..... $5.00 to $5.25 off list
C.p.c. and t. sq. or hex. blank nuts ..... $5.25 off list
C.p.c. and t. sq. or hex. blank nuts, tapped ..... $5.00 off list
Semi-finished hex. nuts:
¼ in. to 9/16 in. inclusive ..... 80, 10 and 10 per cent off list
Small sizes S. A. E. ..... 80, 10, 10 and 10 per cent off list
⅝ in. to 1 in. inclusive, U. S. S. and S. A. E. 70, 10, 10 and 10 per cent off list
Stove bolts in packages ..... 80, 10 and 5 per cent off list
Stove bolts in bulk ..... 80, 10 and 7½ per cent off list
Tire bolts ..... 65, 10 and 10 per cent off list
Track bolts, carloads ..... 3c. to 3.25c. base
Track bolts, less than carloads ..... 4c. to 4.25c.

Upset Square and Hex. Head Cap Screws

½ in. and under ..... 80 and 10 per cent off list
9/16 in. to ¾ in ..... 80 and 10 per cent off list

Upset Set Screws

½ in. and under ..... 80, 10 and 5 to 85 per cent off list
9/16 in. to ¾ in ..... 80, 10 and 5 to 85 per cent off list

Milled Square and Hex. Cap Screws

All sizes ..... 75 and 10 per cent off list

Milled Set Screws

All sizes ..... 70, 10 and 10 per cent off list

Rivets

Large structural and ship rivets $2.25
Large boiler rivets 2.35
Small rivets ..... 70, 10 and 10 per cent off list

Wire Rods

No. 5 common basic or Bessemer rods to domestic consumers, $36 to $38; chain rods, $36 to $38; screw stock rods, $41 to $43; rivet and bolt rods and other rods of that character, $36 to $38; high carbon rods, $43 to $50, depending on carbons.

Railroad Spikes and Track Bolts

Railroad spikes, 9/16-in. and larger, $2.25 base per 100 lb. in lots of 200 kegs of 200 lb. each or more; spikes, ½-in., ⅜-in. and 7/16-in., $2.35 to $2.40 base; 5/16-in., $2.35 to $2.40 base. Boat and barge spikes, $2.35 to $2.40 base per 100 lb. in carload lots of 200 kegs or more, f.o.b. Pittsburgh. Track bolts, 3c. to 3.25c. base per 100 lb. Tie plates, $2 per 100 lb. Angle bars, $2.40 per 100 lb.

Terne Plates

Prices of terne plates are as follows: 8-lb. coating, 200 lb., $9.30 per package; 8-lb. coating, I. C., $9.60; 15-lb. coating, I. C., $11.80; 20-lb. coating, I. C., $13; 25-lb. coating, I. C., $14.25; 30-lb. coating, I. C., $15.25; 35-lb. coating, I. C., $16.25; 40-lb. coating, I. C., $17.25 per package, all f.o.b. Pittsburgh, freight added to point of delivery.

Iron and Steel Bars

Steel bars, 1.50c. from mill. Refined bar iron, 2c. to 2.10c.

Welded Pipe

The following discounts are to jobbers for carload lots on the Pittsburgh basing card:

Butt Weld

Steel: Inches	Black	Galv.	Iron: Inches	Black	Galv.
⅛	54½	28	¼ to ⅜	+ 3½	+22½
¼ to ⅜	60	33½	½	36½	18½
½	65	50½	¾	42½	27½
¾	69	56½	1 to 1½	44½	29½
1 to 3	71	58½			

Lap Weld

2	64	51½	2	39½	25½
2½ to 6	68	55½	2½ to 6	42½	29½
7 to 8	65	51½	7 to 12	40½	27½
9 to 12	64	50½			

Butt Weld, extra strong, plain ends

⅛	50½	33	¼ to ⅜	+ 4½	+37½
¼ to ⅜	56	38½	½	35½	23½
½	62	50½	¾	42½	28½
¾	67	55½	1 to 1½	44½	30½
1 to 1½	69	57½			
2 to 3	70	58½			

Lap Weld, extra strong, plain ends

2	62	50½	2	40½	27½
2½ to 4	66	54½	2½ to 4	43½	31½
4½ to 6	65	53½	4½ to 6	42½	30½
7 to 8	61	47½	7 to 8	35½	23½
9 to 12	55	41½	9 to 12	30½	18½

To the large jobbing trade the above discounts are increased by one point, with supplementary discounts of 5 and 2½ per cent.

Boiler Tubes

The following are the discounts for carload lots f.o.b. Pittsburgh:

Lap Welded Steel		*Charcoal Iron*	
1¾ in.	26½	1½ in.	5
2 to 2¼ in.	41	1¾ to 1⅞ in.	15
2½ to 3 in.	52	2 to 2¼ in.	25
3¼ to 13 in.	57	2½ to 3 in.	30
		3¼ to 4½ in.	32

Standard Commercial Seamless Boiler Tubes

New discounts have been adopted on standard commercial seamless boiler tubes, but manufacturers are not yet ready to announce them for publication, and for that reason we publish no discounts this week.

Sheets

Prices for mill shipments on sheets of standard gage in carloads, f.o.b. Pittsburgh, follow:

Blue Annealed

Cents per Lb.		Cents per Lb.	
No. 8 and heavier	2.20	Nos. 11 and 12	2.30
Nos. 9 and 10 (base)	2.25	Nos. 13 and 14	2.35
		Nos. 15 and 16	2.45

Box Annealed, One Pass Cold Rolled

Cents per Lb.		Cents per Lb.	
Nos. 17 to 21	2.80	No. 28 (base)	3.00
Nos. 22 to 24	2.85	No. 29	3.10
Nos. 25 and 26	2.90	No. 30	3.20
No. 27	2.95		

Galvanized

Cents per Lb.		Cents per Lb.	
Nos. 10 and 11	3.00	Nos. 25 and 26	3.70
Nos. 12 to 14	3.10	No. 27	3.85
Nos. 15 and 16	3.25	No. 28 (base)	4.00
Nos. 17 to 21	3.40	No. 29	4.25
Nos. 22 to 24	3.55	No. 30	4.50

Tin-Mill Black Plate

Cents per Lb.		Cents per Lb.	
Nos. 15 and 16	2.80	No. 28 (base)	3.00
Nos. 17 to 21	2.85	No. 29	3.05
Nos. 22 to 24	2.90	No. 30	3.05
Nos. 25 to 27	2.95	Nos. 30½ and 31	3.10

NON-FERROUS METALS

The Week's Prices

Cents Per Pound for Early Delivery

	Copper, New York		Straits Tin	Lead		Zinc	
Dec.	Lake	Electrolytic*	New York	New York	St. Louis	New York	St. Louis
28	13.87½	13.62½	33.00	4.70	4.40	5.17½	4.82½
29	13.87½	13.62½	32.87½	4.70	4.40	5.20	4.85
30	13.87½	13.62½	33.12½	4.70	4.40	5.20	4.85
31	13.87½	13.62½	....	4.70	4.40	5.20	4.85
Jan. 3	13.87½	13.62½	32.75	4.70	4.40	5.17½	4.82½

*Refinery quotation.

New York

NEW YORK, Jan. 3.

At the beginning of the new year the tone of all the markets is optimistic and the price tendency is strong. The light demand for copper is regarded as temporary and prices are unchanged and firm. The tin market is only moderately active at higher prices than a week ago. Demand for lead is seasonal at unchanged prices, while the demand for zinc is light with quotations unchanged from a week ago.

Copper.—Demand for copper has been exceedingly light, as measured by both inquiry and sales, but prospects for the immediate future are bright. There has been no change in electrolytic prices and the metal is quoted at 13.62½c., refinery, or 13.87½c., delivered, for January and first quarter, although some producers are asking slightly more for delivery beyond January. Inquiry has not broadened beyond the first quarter, unless included in business for the first half, which so far is light. The January quotation of the larger producers for the first quarter is 14c., delivered, or 13.75c., refinery.

Copper Averages.—The average price of Lake copper for the month of December, based on daily quotations in THE IRON AGE, is 13.78c. The average price for electrolytic copper is 13.55c.

Tin.—The closing week of the year has been featured by fairly good sales of early arrivals and actual spot metal, but the total has been small. In futures very little business has been done, although on Friday a few sales were made at 33c. to 33.12½c. Optimism prevails and better buying is expected early in January. Spot Straits tin was quoted to-day at 32.75c., New York, and quotations in London were about £3 per ton lower than a week ago at £168 12s. 6d. for spot standard, £170 10s. for future standard and £170 for spot Straits, with the Singapore price at £173 5s. on Monday. Deliveries into consumption for December were 3710 tons and the stock on Dec. 31 and the quantity in landing were 516 tons and 1180 tons, respectively.

Lead.—Sales of fairly liberal proportions were made last Friday on a basis of 4.40c., St. Louis; otherwise the market has been quiet. The leading interest continues to quote 4.40c., both New York and St. Louis, while in the outside market the St. Louis quotation has stiffened at the firm price of 4.40c., with the New York quotation at 4.75c.

Zinc.—Sales of carload lots constitute the present demand which is light. Prime Western for early delivery is quoted by some sellers at 4.82½c. and by others at 4.85c., St. Louis, sales having been made at both of these levels. We quote the market for January or 30-day delivery at 4.82½c., St. Louis, or 5.17½c., New York, with February and March five points higher, respectively. While inquiry is light for these positions it is believed that demand will be better as the months advance.

Antimony.—The market is quiet and unchanged at 6.50c., New York, duty paid, for wholesale lots for early delivery.

Aluminum.—Virgin metal, 98 to 99 per cent pure, in wholesale lots for early delivery is quoted at 19c., f.o.b. plant, but the same grade is quoted by importers at 17c. to 18c., New York, duty paid. Demand is light.

Old Metals.—Prices are firm though very few transactions are reported. Dealers' selling prices are as follows:

	Cents Per Lb.
Copper, heavy and crucible	13.25
Copper, heavy and wire	12.50
Copper, light and bottoms	10.00
Heavy machine composition	10.25
Brass, heavy	8.00
Brass, light	6.00
No. 1 red brass or composition turnings	8.25
No. 1 yellow rod brass turnings	6.25
Lead, heavy	4.25
Lead, tea	3.25
Zinc	3.00

Chicago

JAN. 3.—The metals were very quiet between the holidays, but copper, lead and zinc made slight advances. The old metal prices remain unchanged. We quote in carload lots: Lake copper, 14c.; tin, 33.75c.; lead, 4.50c.; spelter, 4.90c.; antimony, 6.50c., in less than carload lots. On old metals we quote: Copper wire, crucible shapes and copper clips, 10.75c.; copper bottoms, 8c.; red brass, 8.25c.; yellow brass, 5.75c.; lead pipe, 3.25c.; zinc, 2.37½c.; pewter, No. 1, 23c.; tin foil, 24c.; block tin, 26c.; all buying prices for less than carload lots.

St. Louis

JAN. 3.—Lead and zinc are slightly easier. Lead is quoted at 4.37½c., car lots, and slab zinc, 4.82½c. On old metals we quote: Light brass, 3.50c.; heavy red brass and light copper, 7c.; heavy yellow brass, 4c.; heavy copper and copper wire, 7.50c.; zinc, 2c.; pewter, 15c.; tin foil, 16c.; tea lead, 2c.; aluminum, 9c.

Copper in the United States in 1921

Smelter production of copper from ore mined in the United States was about 205,800 gross tons in 1921; refinery production was about 411,000 tons, of which 268,300 tons was from domestic material and the balance from foreign material. These figures, from the United States Geological Survey, show definite figures for eleven months and the producing companies' estimates for December.

Imports for eleven months amounted to about 142,000 gross tons, of which 30,400 tons was refined and 70,100 tons blister copper, the balance being ore, concentrates and matte. Exports for eleven months totaled about 253,000 gross tons, of which 240,000 tons was new refined copper, and 13,000 tons manufactured—wire, rods, pipes, tubes, sheets, etc.

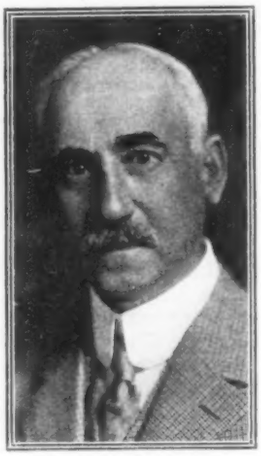
Domestic consumption of refined copper is estimated at 255,400 gross tons, compared with 470,500 tons in 1920, as shown in the following table:

Gross Tons	1920	1921
Refinery production:		
from domestic sources	527,700	268,300
from foreign sources	153,600	142,900
Imports of refined copper	48,700	33,500
Stocks, Jan. 1, 1921	281,700	294,200
Total available	1,011,700	738,900
Exports, exclusive of manufactured	247,000	262,000
Stocks, Dec. 31, 1921	294,200	221,500
	541,200	483,500
Domestic withdrawals	470,500	255,400

The Worcester, Mass., section A. S. M. E., held a smoker in the Boys' Trade School Tuesday evening, Jan. 3, at which C. L. Ipsen, General Electric Co., delivered an address on Mechanical Heating Problems Solved Electrically. A. M. Brewster, Atlas Die Casting Co., Worcester, will talk on Manufacturing and use of Die Castings, at a meeting of the Worcester section, on Jan. 24, at the North Works, American Steel & Wire Co. F. Harold Daniels, R. Sanford Riley Stoker Co., Worcester, also will talk, on a Closeup of Stoker Combustion, using moving pictures.

PERSONAL

Edward Worcester, vice-president in charge of sales, National Tube Co., Pittsburgh, has resigned, effective Jan. 1. Mr. Worcester has been identified actively with the tubular steel trade for more than 30 years, and has a legion of friends from the Atlantic to the Pacific who hold him in the highest esteem. He retires from active business to take a well earned rest, but will still hold an inactive connection with the National Tube Co. He will devote his time to private interests and further study of subjects in which he is vitally interested. Mr. Worcester was born in East Bridgewater, Mass., Jan. 29, 1855, and his first business connection was with the Chapman Valve Co., Boston. He entered the employ of that company in 1870, just 52 years ago, and in 1875 had reached the position of salesman. He left that position in 1875, to become head salesman in the Chicago agency of the National Tube Works Co. From 1877 to 1882 he was salesman for Walworth Mfg. Co., Boston, and from 1882 until 1886 he was assistant secretary, and later secretary of Crane Bros. Mfg. Co., Chicago. In 1888, he was appointed local manager of the St. Louis office of the National Tube Works Co., combined with this being the position of secretary of the Western Tube Co., Keewanee, Ill., in which the National Tube Works Co., in 1890, acquired an interest. In 1897, Mr. Worcester was appointed assistant sales manager of the National Tube Works Co., McKeesport, Pa. This company was later taken over by the United States Steel Corporation, which also took over nearly every important tube plant in the country, and its name was changed to the National Tube Co. In 1903, he was appointed vice-president of the National Tube Co., in charge of sales, which position he held until his retirement. John H. Nicholson, who has been with the company for 22 years, for several years as vice-president in charge of operations of the seamless tube plants of the company, relinquishes those duties to take up those of Mr. Worcester. Mr. Nicholson was one of the owners of the Standard Seamless Tube Works, Ellwood City, Pa., which was acquired by the National Tube Co., in 1900, at which time he became affiliated with the latter. Taylor A. Allderdice, vice-president in charge of operations at all except the seamless tube works, now takes charge of operations at all plants of the company.



EDWARD WORCESTER

Peter S. Steenstrup, vice-president and general manager General Motors Export Co. New York, has been appointed assistant to Alfred P. Sloan, Jr., vice-president in charge of operations of the General Motors Corporation.

H. E. Forbes, Buffalo, has been elected president of the Pierce Arrow Motor Car Co., succeeding Col. George W. Mixter, resigned. Col. Charles Clifton will continue as chairman of the board.

Edwin C. Foster has been appointed manager of the Pittsburgh sales office of E. J. Lavino & Co., Bullitt Building, Philadelphia, manufacturers of ferromanganese and other ferroalloys. The company's new Pittsburgh office is in the Oliver Building. Mr. Foster has for some time been associated with the company at its main office in Philadelphia.

Bruce Haines, assistant manager Crawfordsville Wire & Nail Co., Crawfordsville, Ind., has resigned and will become general manager of the Davenport, Iowa, branch of the Nichols Wire & Sheet Co. Kansas City, Mo.

Ferdinand W. Roebling, John A. Roeblings' Sons Co., Trenton, N. J., has been elected a director of the Otis Elevator Co. New York.

Col. William C. Skinner, formerly president Colt's Patent Fire Arms Mfg. Co., Hartford, Conn., has sailed for South America to be away about a month. He is recovering from a nervous illness.

S. F. Bowser, founder and president of S. F. Bowser & Co., Fort Wayne, Ind., manufacturers of pumping equipment, has retired from the presidency of the company and will be succeeded by S. B. Bechtel, general manager of the company for the past seven years.

Edward M. Adams will be first vice-president and general manager of sales of the Inland Steel Co., succeeding G. H. Jones. Walter C. Carroll will be vice-president in charge of sales for the sheet division, and Charles R. Robinson vice-president in charge of sales for the rail and track accessories division. Photographs and biographical sketches of Messrs. Jones and Carroll were published in these columns on Nov. 10 and 3, 1921, respectively. Edward Martin Adams has spent 16 years of his business career with the Inland company. He was born at Cherry Valley, Ill., on Dec. 1, 1876, and there learned telegraphy. For a number of years he served as telegraph operator and agent at various points on the western lines of the Illinois Central Railroad, and in 1900 became identified with the Buda Co., Harvey, Ill., as traffic manager. Five years later he joined the staff of the Inland Steel Co. as secretary, a position which he held continuously until August, 1919, when he was made vice-president and secretary. By virtue of his long and uninterrupted service with the Inland organization at Chicago, Mr. Adams has won a wide acquaintanceship in the territory his company serves and has acquired a thorough knowledge of the individual requirements of consumers in a large section of the country. An understudy of his predecessor ever since he became identified with the iron and steel industry, he is expected to carry forward the sales policies which were in no small measure responsible for the meteoric growth of the Inland company.

W. C. Starkey, for several years chief engineer of the Ohio Brass Co., Mansfield, Ohio, on Jan. 1 became vice-president and directing engineer of the Stevenson Gear Co., Indianapolis, manufacturer of gear cutting machinery.

G. H. Jones, who resigned as first vice-president and general manager of sales of the Inland Steel Co., Chicago, effective Jan. 1, has leased quarters at 1212 First National Bank Building, Chicago, where he will direct the affairs of the Hillside Fluor Spar Mines, Rosiclare, Ill., of which company he is president and treasurer. The Rosiclare property, which is being developed at a cost of several hundred thousand dollars, will go into production early this year. Associated with Mr. Jones in this undertaking as vice-president and general manager is Capt. A. B. Thomas, who has been identified with the fluorspar mining industry since its inception. Mr. Jones retains his heavy interests in the Inland Steel Co. and will continue to serve on its board of directors.

E. W. Goodwin, former engineer for the Packard Motor Car Co., Detroit, has taken a similar position with the Maxwell-Chalmers Co., Detroit.

George M. Humphrey, for several years with the legal department of M. A. Hanna & Co., Cleveland, became a partner in that firm on Jan. 1.

George W. McCandless, secretary and treasurer McConway & Torley Co., Pittsburgh, has been named by Mayor Magee of that city as director of the department of public safety, which embraces the police and fire departments.

Charles E. Drum has been made general manager of the Hayes Manufacturing Co., Detroit, and Joseph Richard chief engineer.

George H. Kuhn, who has been at the Detroit office of the Charles Dreifus Co., Pittsburgh, scrap iron and steel, for the past year, has been transferred to the Cleveland office of the company, in the Guardian Trust Building.

C. F. Rogers, formerly with C. E. Johansson, Inc., Poughkeepsie, N. Y., has joined Purinton &

Smith, machinery and tools, Hartford, Conn., in a selling capacity.

Elton Hoyt, II, who has been associated with Pickands, Mather & Co., Cleveland, for a number of years, and has for some time had charge of that firm's ore sales, was made a member of the firm Jan. 1.

Howard R. Williams has been appointed Philadelphia district sales manager of the Electric Alloy Steel Co., Youngstown, Ohio. The company's Philadelphia office is at 511 Pennsylvania Building. Mr. Williams has been assistant to the general manager of sales at Youngstown and formerly was with the Youngstown Sheet & Tube Co.

John J. Brant, general auditor Youngstown Sheet & Tube Co., Youngstown, Ohio, retired Dec. 31. He will continue to make his home in Youngstown, where he has resided since 1885. He was appointed auditor of the company in 1911, having previously been in the auditing and accounting departments. He has served with the company for 20 years.

George Martin has resigned as auditor of the Youngstown Steel Car Co., Niles, Ohio. He had been previously identified with Price, Waterhouse & Co.

OBITUARY

MASON EVANS, aged 72, for many years actively identified with financial and industrial enterprises of the Mahoning Valley, died Dec. 26 at his home in Youngstown, Ohio, from paralysis, following several years of declining health. His most active connection in the steel industry was as treasurer of the old Youngstown Iron & Steel Co., now the property of the Sharon Steel Hoop Co., Sharon, Pa.

F. ALEXANDER WITTE, president Witte Hardware Co., St. Louis, died Dec. 27 at his residence in that city, at the age of 54 years. He was born in St. Louis Oct. 2, 1868.

EMIL L. MAYER, aged 57, Pittsburgh district manager International Harvester Co. of America, died in his home in Bellevue, Pa., Dec. 28. He had been associated with that company for 41 years, entering its employ as an office boy. He had been general manager in Pittsburgh for 11 years.

THOMAS E. DWYER, president Wakefield Lead & Pipe Co., Lowell, Mass., died Dec. 26 at the St. John's hospital, that city, after an illness of about a month.

WINFIELD EVERETT HOLMES, treasurer Samuel M. Green Co., Springfield, Mass., and an authority on industrial processes, methods and equipments, steam and hydraulic power plants, the elimination of waste in industrial processes, and in the generation of power, died Dec. 25, at his home in Springfield, following a five months' illness. Mr. Holmes was born May 10, 1881.

DAVID J. BRAUN, one of the pioneers in the lighting fixture business, died in Chicago, Dec. 26 at the age of 79. He learned the metal spinning trade in Württemburg and came to America in 1866 and to Chicago in 1874. In 1889 the David J. Braun Mfg. Co. was incorporated and later consolidated with the Beardslee Chandelier Mfg. Co., and was the first factory in Chicago for manufacturing lighting fixtures.

The David J. Joseph Co., Cincinnati, dealer in waste material, has increased its capitalization by the issue of $500,000 preferred stock, which has been fully subscribed. This makes the capitalization of the company $1,250,000, of which $750,000 is common stock. This company, which was organized one year ago, during the year opened yards at Chicago and St. Louis and has also opened an office in Pittsburgh. The increased capitalization will be used in further extending its operations.

Navy Sells 13 Vessels

Bids to be submitted for the several battleships and monitors this month may be influenced by prices at which the Navy Department last week sold 13 vessels of different types, the largest being the triple-screw cruiser Brooklyn, at Mare Island, Cal., appraised at $200,000 and sold to the American Iron & Metal Co. of California, for $46,667. These vessels, however, are smaller than the battleships and monitors to be sold and will not prove to be so great a task in dismantling as the heavier armored battleships will. Among other ships sold, the prices they brought and their appraised values, follow:

Vessel	Price	Appraisal	Buyer
Transport Astoria, at Boston	$30,500	$130,000	Richard T. Green Co., Chelsea, Mass.
Yacht Vega, at Philadelphia	10,000	102,000	C. H. Crocker, San Francisco
Lighter 160, at Mare Island	5,725	12,000	Hunt, Hach & Co., Oakland, Cal.
Training ship Intrepid, at Mare Island	4,015	20,000	M. Parker, San Francisco
Yacht Galatea, at Portsmouth, N. H.	4,400	116,000	A. A. Tanos, New York
Destroyer Smith, at Philadelphia	6,176	7,000	Jos. G. Hitner Sons Co., Philadelphia
Eagle No. 25, at Philadelphia	1,026	5,000	Jos. G. Hitner Sons Co., Philadelphia

The list on which bids are to be received Jan. 16 includes the battleships Maine, Missouri and Wisconsin at Philadelphia, each appraised at $120,000; the monitors Puritan and Miantonomah, at Norfolk, Va., and the Ozark and Tonopah, at Philadelphia; the wrecked cruiser Memphis, at Santo Domingo and the triple-screw cruiser Columbia, at Philadelphia, appraised at $300,000. The monitors are appraised at from $4,000 to $40,000.

Bourne-Fuller Plant Resumes

Describing its action as an experiment towards improving industrial conditions the Bourne-Fuller Co., Cleveland, resumed operations on its Upson Nut steel plant and blast furnace Jan. 3. The blooming mill and three of the five open-hearth furnaces will be operated. The finishing mills will be run to fill orders as received. Surplus steel beyond requirements of the finishing mills will be stored in semi-finished form. The company's stack has been out of blast since last January and its open-hearth department was operated only four months last year.

The employees expressed a willingness to take a cut in wages rather than to remain longer out of work and a flat reduction of 15 per cent was made. This places common labor on the basis of 25½c. per hour. The company promised its employees that it would keep the plant in operation three months and hopes by the expiration of that time business will have improved sufficiently to permit it to continue operations.

Inquiries for Coke

UNIONTOWN, PA., Jan. 3.—The new year is being ushered in in the Connellsville bituminous region with first inquiries for coke tonnage for the first half of the year. Only one contract is reported so far and that semi-officially. It is to the effect that an Eastern steel company has contracted for 7,500 tons of furnace coke monthly for three months at $3 a ton.

Output in the region has fallen off slightly during the past two weeks.

Investigations on the carbonization of lignite have been under way for some time under the direction of Dr. E. J. Babcock, dean of the mining engineering department of the University of North Dakota. In a bulletin of the Bureau of Mines, W. W. Odell, fuel engineer of the bureau, gives preliminary information, including a sketch of the carbonizer employed. Twenty tons of raw lignite were carbonized per day and by-products are recovered. The briquetting equipment rolls pillow-shaped briquets weighing approximately 2¼ oz. each.

Iron and Steel Markets

(*Continued from page* 127)

roads features the iron and steel market. The Alabama, Tennessee & Northern Railroad has placed an order with the Mount Vernon (Ill.) Car Co. for 250 gondola cars and 50 sets of steel underframes for cars. The Missouri Pacific has an inquiry out for 100 wheels, and the Wabash wants a quantity of boiler tubes—about 100 tons being involved. The Missouri, Kansas & Texas Railroad will shortly start work on new freight terminals at Denison, Tex., the biggest part of the work being the laying of approximately 30 miles of track, for which 85 lb. relaying rails already on hand will be used. Distributors are buying heavily of pipe for use in the oil fields at Mexia, Texas.

For stock out of warehouse we quote: Soft steel bars, 2.77½c. per lb.; iron bars, 2.77½c.; structural shapes, 2.87½c.; tank plates, 2.87½c.; No. 10 blue annealed sheets, 3.47½c.; No. 28 black sheets, cold rolled, one pass, 4.15c.; cold drawn rounds, shafting and screw stock, 3.65c.; structural rivets, $3.52½ per 100 lb.; boiler rivets, $3.62½; tank rivets, 7/16 in. and smaller, 65 and 5 per cent off list; machine bolts, large, 60-10 per cent; small, 60, 10 and 10 per cent; carriage bolts, large, 55-5 per cent; small, 60 and 10 per cent; lag screws, 65-5 per cent; hot pressed nuts, square or hexagon blank, $4; and tapped, $3.75 off list.

Old Material.—The market for old material remains very weak, and continues to drag, although prices have changed very little. There has been a consumptive buying. A few transactions between dealers are reported, where contracts expiring and deliveries must be made before the end of the year. Inquiries for relaying rails are picking up, and it is reported that some good-sized contracts will be closed early in January. Current railroad offerings include: Missouri, Kansas & Texas, 1250 tons; Pennsylvania System (Southwestern Region) 4100 tons; Louisville, Henderson and St. Louis, 500 tons; Baltimore & Ohio, 11,000 tons and an open list issued by the New York Central.

We quote dealers' prices f.o.b. consumers' works, St. Louis industrial district and dealers' yards, as follows:

Per Gross Ton	
Iron rails	$15.50 to $16.00
Steel rails, rerolling	12.00 to 12.50
Steel rails, less than 3 ft.	12.00 to 12.50
Relaying rails, standard section	23.00 to 28.00
Cast iron car wheels	15.00 to 15.50
No. 1 heavy railroad melting steel	11.00 to 11.50
No. 1 heavy shoveling steel	10.50 to 11.00
Ordinary shoveling steel	10.00 to 10.50
Frogs, switches and guards cut apart	11.00 to 11.50
Ordinary bundle sheet	4.50 to 5.00
Per Net Ton	
Heavy axles and tire turnings	$5.50 to $6.00
Iron angle bars	13.50 to 14.00
Steel angle bars	10.00 to 10.50
Iron car axles	18.00 to 18.50
Steel car axles	13.50 to 14.00
Wrought iron arch bars and transoms	13.50 to 14.00
No. 1 railroad wrought	9.50 to 10.00
No. 2 railroad wrought	8.50 to 9.00
Railroad springs	11.50 to 12.00
Steel couplers and knuckles	11.50 to 12.00
Locomotive tire, 42 in. and over, smooth inside	8.50 to 9.00
No. 1 dealers' forge	7.50 to 8.00
Cast iron borings	6.00 to 6.50
No. 1 busheling	9.00 to 9.50
No. 1 boilers cut in sheets and rings	7.50 to 8.00
No. 1 railroad cast	13.50 to 14.00
Stove plate and light cast	12.00 to 12.50
Railroad malleable	9.50 to 10.00
Agricultural malleable	9.00 to 9.50
Pipes and flues	7.50 to 8.00
Heavy railroad sheet and tank	6.50 to 7.00
Light railroad sheet	4.50 to 5.00
Railroad grate bars	9.50 to 10.00
Machine shop turnings	5.00 to 5.50
Country mixed iron	7.00 to 7.50
Uncut railroad mixed	7.50 to 8.00
Horseshoes	10.00 to 10.50
Railroad brake shoes	9.50 to 10.00

Leonard Kennedy & Co., 67 Wall Street, New York, have not purchased machinery against their contract for removing a hill in Rio de Janeiro, Brazil. They are now negotiating for hydraulic equipment, including motors, pumps, flumes, etc., and will probably begin work about May. At present, the hill is being removed by hand, the method of the former Brazilian contractor.

British Iron and Steel Markets

Falling and Selling Prices Getting Nearer Continental Prices—Naval Contracts Abandoned

(*By Cable*)

LONDON, ENGLAND, Jan. 3.

There is more inquiry for pig iron; but the reductions in English and Welsh railroad rates was disappointing, amounting to only 1s. (21c.) on pig iron. Scottish railroads refuse any concession. Cheaper pig iron is expected shortly, as makers desire to get more furnaces to blowing.

Improved demand for hematite is in evidence, but the output is adequate to take care of it. Foreign ore is duller; freight charges from Bilbao to Middlesbrough are easier. The best Rubio ore is quoted at 26s. ($5.46) c.i.f. Tees.

Some Northeastern steel works are resuming operations this week; but the Scotch steel plants remain closed, probably for fourteen days. The position is brighter, for costs are falling and selling prices are more nearly approaching those for Continental materials. Steel beams are now sold at from £8 to £8 5s. (1.50 to 1.55c. per lb.) f.o.b.; boiler plates, to Lloyds' test, have been done at £12 10s. (2.34c. per lb.) f.o.b.

Guest, Keen & Nettlefolds, Ltd., proposes to electrify the entire Dowlais works. Vickers and Armstrong interests are negotiating for the purchase of the Woelkersdorf arsenal. The Forth Shipbuilding & Engineering Co. has registered its nominal capital at £315,000 [previously £300,000].

Continental business is quiet. Belgian beams are being sold at £7 10s. (1.41c. per lb.) f.o.b.; Belgian merchant bars at £7 12½s. to £7 15s. (1.43 to 1.45c. per lb.) f.o.b., for January and February shipment. French merchant bars are held at £8 (1.50c. per lb.) f.o.b., for January and February. Belgian plates are quoted up to £10 (1.87½c. per lb.) f.o.b. for quick shipment. German rods are being sold at £8 10s. (1.59c. per lb.) f.o.b. for shipment in first quarter. No. 3 Belgian bar iron is quoted at £9 15s. (1.83c. per lb.) delivered to the Midlands.

Tin plate outlook is disappointing. Prices are easier, January shipment being sold at 19¾s. ($4.15) basis f.o.b. Prompt 28 x 20 in. sizes are offered at 40s. ($8.40) f.o.b. The export demand is quiet. Wasters are weaker; quarters are offered at 20s. ($4.20) f.o.b., ex-stock. Twenty x 14's are quoted at 19s. ($3.99) f.o.b.

Galvanized sheets are weak and some makers are considering closing down. Black sheets are easier, Japanese specifications being offered at £17 10s. (3.28c. per lb.) f.o.b., without response.

We quote gross ton, except where otherwise stated, f.o.b. maker's works, with American equivalent figured at $4.20 per £1 as follows:

Durham coke, delivered	£1 8½	to £1 10	$5.98 to $6.30
Cleveland No. 1 foundry	5 5	& 5 10*	22.05 & 23.10*
Cleveland No. 3 foundry	5 0	& 5 5*	21.00 & 22.05*
Cleveland No. 4 foundry	4 15		19.95
Cleveland No. 4 forge	4 10		18.90
Hematite	7 0*		29.40*
East Coast mixed	5 0	& 5 2½*	21.00 & 21.52*
Ferromanganese	15 0	& 14 10*	63.00 & 60.90*
Rails, 60 lb. and up	8 10	to 9 10	35.70 to 39.90
Billets	8 0	to 8 5	33.60 to 34.65
Sheet and tin plate bars, Welsh	7 15		32.55
Tin plate, base box	0 19¼	to 1 0¼	4.04 to 4.25
			C. per Lb.
Ship plates	9 10	to 10 10	1.78 to 1.97
Boiler plates	14 0	to 14 10	2.62 to 2.72
Tees	10 0	to 11 0	1.87 to 2.06
Channels	9 5	to 10 15	1.73 to 2.02
Beams	8 0	to 10 0	1.50 to 1.87
Round bars, ¾ to 3 in.	10 10		1.97
Galvanized sheets, 24 g.	16 10		3.09
Black sheets	13 10		2.53
Steel hoops	12 0	& 12 5*	2.25 & 2.30*
Cold rolled steel strip, 20 g.	24 10		4.59

*Export price.

Machine Tool Industry Had a Poor Year

Industry Has Not Suffered So Greatly Because of Lack of Orders in Any Previous Business Depression

At least it can be said that the machine-tool industry enters upon the New Year with much better prospects than it faced a year ago. Then the business depression had barely set in. Now a whole year of readjustment of selling prices, production costs and other factors entering into the situation has gone by and the mood of buyers is of a much more encouraging character. Aside from the fact that the need of machine tools by metalworking industries was at low ebb the past year because of lack of work, the great number of new and used machines offered for sale at "bargain" prices, most of them leftovers from the war, cut a deep hole in the business which the machine-tool builders might otherwise have got. Many of the machine-tool plants received so little business during a part of the year that their plants were wholly or partially shut down for weeks or months at a time. Many of the tools owned by the War Department, which inventoried at millions of dollars, have been turned over to vocational training schools and thus are eliminated as a factor in the market. Stocks still held by Government departments are relatively unimportant.

Railroad Buying the Hope of Eastern Machine-Tool Trade

OWING to the lack of work among metalworking industries and to the retrenchment policies of most of the large manufacturing companies in the East, the year 1921 was a very poor one with machine-tool sellers in the New York market. Most of the large plants in the East, in common with those elsewhere in the country, were left with large stocks of machine-tool on their hands when the slump in business set in, and many of them became sellers, rather than buyers, of tools. Those which really needed new shop equipment were hesitant about buying in the early part of the year because of the possibility of price reductions, and when these reductions finally came, affecting almost every make of machine tool, they still hesitated on the theory that the liquidation of prices had barely begun. Much of the buying was confined to single machines urgently needed, and there was a great deal of "bargain hunting."

Many used machines in good condition were offered for sale, and in addition there was a considerable number of new machines, which were sold at "second-hand" prices, to attract business away from the regular manufacturing companies.

Price readjustments during the year were many and sweeping, and while prices have not gone back fully to the 1914 level, they are not far out of line when present higher labor costs and higher costs of material, transportation, etc., are taken into consideration.

The first half of the year was uneventful so far as important business is concerned. Nor was the last half of the year active, though an improvement was noted beginning in August or September. Sales in October reached a fair volume in comparison with the low sales records of earlier months of the year.

The trade was buoyed up by hopes of railroad buying when inquiries began to make their appearance in the fall. The Delaware, Lackawanna & Western issued an inquiry for about 40 machines early in October. The Erie inquired for 64 machines in November, and eventually purchased a part of this list, filling its requirements, however, largely with used tools. The American Locomotive Co. inquired for 35 machines in late November and purchased the entire lot, this constituting probably the largest single piece of machine-tool business completed in the New York district within the year.

Other railroad inquiries have been issued, but action was deferred. The Chesapeake & Ohio took bids on about $100,000 worth of shop equipment, but has not yet bought. The Delaware & Hudson recently issued a small list.

While the trade looks for no marked revival of machine-tool buying early in 1922, the prospects are better than were faced a year ago. Usually among the first to feel the effects of a depression, the machine-tool industry is also usually the last to recover. It is now awaiting a more general recovery of business activity as a prelude to better buying of its products.

Chicago Machine Tool Market Dull in 1921

MACHINE-TOOL buying was exceptionally light in the Chicago district in 1921. In fact, representative dealers estimate that their total sales for the year will not exceed 20 or 25 per cent of those of 1920. Agricultural implement manufacturers bought practically nothing; the automotive industry purchased little, and industrial plants as a whole made few additions to their equipment during the year. While railroad purchases stood out in bold relief because of their size, they were few in number and in the aggregate represented a much smaller outlay than their expenditures for tools in the preceding year. Although it cannot be said that there was active buying by any class of users, purchases by schools, motor service stations and small manufacturers of dwelling house appurtenances were notable in a dull market.

Prices of machine tools declined during the course of the year. In January two makes of engine lathes were reduced 7½ and 10 per cent, respectively. In January and February, several manufacturers of shapers announced cuts of 15 per cent. In February and March, milling machines went down an average of 15 per cent. On April 1, the leading lines of planers, engine lathes and radial drills were reduced 10 per cent. In August milling machines were again reduced 10 to 15 per cent and in October engine lathes, radial drills and shapers were again cut 10 to 15 per cent. Similar reductions in other types of tools were made throughout the year.

Notwithstanding price reductions, the sale of new equipment was impeded by offerings of second-hand tools. Numerous auctions of the stocks of bankrupt manufacturers threw considerable used equipment on the market at low prices. The absorption of these tools, in part, accounts for the small sales of new equipment throughout the year. In some cases, buyers showed no interest in new machines and covered their entire requirements by purchasing second hand tools. Thus $250,000 worth of used equipment was bought for a new Minneapolis plant which went into the manufacture of automotive replacement parts.

The outstanding purchase of new equipment in the first half of the year was that of the Atchison, Topeka & Santa Fe R. R., which bought $125,000 worth

of tools for its Albuquerque, N. M., shops. This list brought out concessions of 10 per cent or more under the then prevailing prices. During April and May small sales to automobile manufacturers were recorded, evidently reflecting the seasonal revival in that industry. In June the Great Northern R. R. closed for $25,000 worth of equipment, and toward the end of July the Illinois Central bought $150,000 worth of tools at sharp concessions. No further buying of consequence occurred until October and November, when additional railroad business was closed. The Virginian placed orders for $20,000 worth, while the Missouri, Kansas & Texas closed for a list of 86 tools. The Santa Fe also bought a few additional items, including an axle lathe, a 1500-lb. steam hammer and a number of sheet metal working machines. The Hurley Machine Co., manufacturer of washing machines, Chicago, bought 15 power presses representing a total outlay of $20,000. Another order taken in the Chicago district toward the close of the year covered complete equipment for a plant of the Richmond Car Co., Inc., Richmond, Va.

Throughout the year, inquiries were repeatedly issued and withdrawn. This was particularly true of railroad lists. The Santa Fe and the Illinois Central bought only after much delay, whereas the Rock Island, which has had a list before the trade most of the past year, has not yet bought.

New England Machine Tool Market for 1921

CONSERVATIVE estimates place sales of new machine tools in New England during 1921 at approximately 12½ per cent of those for 1920. In other words, sales probably have not amounted to much more than $500,000, whereas, in 1921 they easily amounted to $4,000,000. This percentage is based on dollars and cents alone. When the number of individual tools sold is taken into consideration, the showing is not so poor. The unfavorable showing is due more to the price situation than to actual consumption.

Of the new machines sold this year, the textile machinery makers and allied interests have been by far the heaviest buyers both from the number of individual tools and price standpoints. Educational institutions have been market factors, but the purchase of approximately $30,000 new metal working equipment by a Connecticut maker of ship engines probably constitutes the most notable exception to textile machinery buying. Included in the estimated sales of $500,000 are cranes. In fact, the crane market has been a considerable factor in pulling up sales to that basis. Power house cranes have dominated the market.

A miscellaneous assortment of machine tools has been purchased. February generally is conceded to be the low sales point of the year. The next low point was August, but sales in that month did not fall as low as in February. Since August the trend of business has been upward; consequently, that month is generally spoken of as the low point of the year. The upswing since August has been very slow, but sufficient to lend considerable encouragement to manufacturer and seller of machine tools.

The outlook for 1922 is for further improvement. Machine tool interests look for other than textile machinery makers to come into the market, and indications are the New England railroads will buy some badly needed equipment.

The number of used machine tools sold here during 1921 is much larger than the new, but here again the price situation has made for an unprofitable year. In 1920 the used machinery market had Government supplies to draw upon. Such supplies were practically eliminated during the early part of 1921, but a new supply —bankrupt manufacturers'—soon developed. The new supply dwindled to small proportions during the last quarter of 1921, and, as a result, the used tool market has been thoroughly cleaned up on several lines of machines.

Cleveland Machine Tool Market

WITH the buying of machinery at low ebb, the machine tool industry in Cleveland experienced its worst year during 1921. For a number of years, leaving out of consideration the unusual demand during the wartime period, the automobile industry had been the main source of the machine tool business in the Central West and during some otherwise dull periods the demand from this field held up well and furnished the backbone of activity. With the reaction following the tremendous plant extension of automobile companies in 1920, sales of machinery to motor car builders came almost to a stop. Some orders were placed by automobile plants during the year, but these were almost wholly for improved tools for replacements to cut down production costs. These orders were for single machines, or at the most small lots. In no case was there any buying in round lots to increase production. Late in the year, there was a little more activity in the automobile field owing to purchases by one or two new companies that were preparing to equip motor car plants.

Makers of automobile parts and accessories bought some machinery during the early part of the year, the demand from this source being better than from the motor car companies. Another allied industry, the tire making industry, had been for several years a good source for machinery orders, particularly for equipment for making tire molds, but the capacity of the tire making plants had been extended to beyond the country's consuming capacity for the output, so that virtually no machinery was purchased during 1921 by either the Akron tire makers or the foundries and machine shops that specialize on tire molds. Other industries did little buying during the year as in most metal working lines, plant capacities had been greatly increased and with plant operations sharply reduced, there were few shops that did not have a great deal of idle machinery.

The machine tool business showed some revival during the last two or three months of the year, but orders, as earlier in the year, were mostly for single machines. Throughout the year large industrial companies as a rule kept out of the market, the bulk of the business coming from small shops. Railroads in the Cleveland territory bought scarcely any machinery during the year, but the improved demand from railroads in other sections brought a few orders late in the year to Cleveland machine tool builders. There was very little building of industrial plants in the Central West during the year and consequently, the demand for equipment for new shops was negligible. A bright spot in the market was the development of some demand for machinery for equipping manual training schools, several of which were built recently in industrial centers.

Foundry operations in Ohio were down to 25 per cent or less of capacity during the year and very few orders were placed by foundries for either machine tools, molding machines or other equipment. Machinery orders come in goodly numbers from steel plants when conditions are normal, but there was virtually no demand from this source during the year.

The price situation was an important factor in the market during the early part of the year. Some buyers withheld orders, waiting for lower prices, but the prediction that lower prices would not stimulate sales apparently proved true.

Probably the predominating feature in the machinery market during the year was the large amount of used machinery offered. This began to come out early in the year when considerable machinery purchased during the previous year was placed on the market. By the time this machinery was delivered, it

was not needed, as the business slump had come and considerable of this machinery had not been uncrated. Later, other surplus machinery was dumped on the market by automobile companies that were curtailing capacities and by plants in other fields. Equipment of small plants that had gone out of business with the depression added to the total. Late in the year, the General Motors Corporation gathered up in Detroit 1500 used machines from its various plants and placed them on the market. The demand for used machinery appeared better during the year than for new tools, this being due to the general policy of buyers to keep their investments for equipment down as low as possible. However, the used machinery moved slowly, as it was offered faster than it could be absorbed.

Early in the year, Cleveland machine tool builders kept their plants in fair operation, building machines for stock, but when they had accumulated good sized stocks and the expected revival of business had not appeared, they either cut production way down or in some cases shut their plants down entirely. Some of these have fairly large stocks on hand at present.

The Machine Tool Industry of Cincinnati

THE machine tool industry in Cincinnati during 1921 experienced probably the dullest year in a decade. Practically all of the manufacturing plants were closed for the greater part of the year, although a few managed to keep running with a skeleton of their normal force. While this condition was common throughout the country, Cincinnati, which is the center of the industry, was probably harder hit than any other section. Some of the smaller shops were able to run for several months in the early part of the year, but taking the 12 month period, it is doubtful whether the average operation in the industry was 15 per cent as compared with what might be considered a normal period.

The year opened with virtually all of the shops closed, but during the early months of the year some of these were re-opened with a greatly reduced force and a shorter schedule of working hours. In January a small volume of export inquiries appeared, but with the exception of some South American business, very few orders were placed. Reduction in wages in the industry made it possible for some of the shops to keep running, making up stock. During the month of February, however, business was very quiet and plants which had been running on reduced schedules were shut down entirely. In the early part of March, machine tool prices were cut approximately 10 to 15 per cent. In this month, some buying developed, principally by the Santa Fe Railroad and the Japanese Government. In the latter part of the month, conditions were somewhat improved and some export orders were placed. Lathe manufacturers made a cut in prices and this was followed by some reinstatement of old orders. Early in April, German manufacturers were offering machine tools and machine tool supplies in this country at very low prices, but such was the state of industry in general that no records of orders being placed were available. From April to June the machine tool business was very quiet, although during the month of May the Big Four Railroad issued an inquiry for $80,000 worth of tools. The month of June was the best so far this year but in July orders were very scarce and practically all of the shops were again closed down.

Along toward the middle of August a slight improvement was noticed, the automobile industry showing some activity. In September a number of shops which had been closed for several months opened up with small forces. From then until the close of the year a gradual improvement was noticed and although the orders were small, nevertheless they were such as to give encouragement to the manufacturers. During this period, some fair sized orders were placed, chief among them being approximately $75,000 worth of tools for the Big Four Railroad, 10 machines for the Virginian Railway and about 70 tools for the M. K. & T. Railroad. The International Nickel Co. was also a fair buyer, and several fairly large orders were booked for export to Cuba and South America.

During the closing months of the year, the complexion of the inquiries was greatly improved, giving rise to the hope that next year will probably be a much better one for the machine tool manufacturers. Orders booked during the last three months were also greater in number and altogether the indications point to a better business in 1922 than was had during 1921. Stocks in manufacturers' hands are being steadily, though slowly, disposed of and the great majority of the plants have very few tools available for immediate delivery.

Hopes Not Realized at Pittsburgh

THE story of the machinery and machine tool markets in Pittsburgh in 1921 is one of hope deferred. It was such a lean year in the steel and allied industries, to which the machinery trade looks largely for business in this district, as regards business and a losing one so far as profits are concerned, that while a good many inquiries came out for equipment, actual orders were relatively few and a good many projects, against which quotations went in early in the year, still were only prospects at the close of the year. The largest piece of business placed during the year was for the new plant of the International Nickel Co., Huntington, W. Va. For this plant 10 cranes of capacities varying from 5 to 10 tons were placed, the order going to Manning Maxwell & Moore, distributors of the Shaw crane. The merchant mills, 7 in number, for this plant were awarded to the United Engineering & Foundry Co., Pittsburgh, and a 30-in. sheet mill and a 26-in. cold mill went to the Standard Engineering Works, Ellwood City, Pa.; Chambersburg Engineering Works and the Massillon Foundry & Machine Co. divided an order for 4 hammers; Allis-Chalmers Mfg. Co. was awarded motors and controllers for 30-in. sheet mill, 26-in. cold mill, 24-in., 20-in., 14-in. and 9-in. merchant mills, the Westinghouse Electric & Mfg. Co. a variable speed set to drive the 9-in. and 10-in. merchant mills and the General Electric Co. the transformers, the motor-generator set and the main switch board. The Mesta Machine Co. was the successful bidder for the mill drives, one of 1200 hp. for the 30-in. sheet mill, one of 300 hp. for the 26-in. cold mill, one of 1200 hp. for the 24-in. billet mill, one of 1100 hp. for the 20-in. bar mill, one of 800 hp. for the 14-in. merchant mill and three of 500 hp. for the 10-in. merchant mill, the 9-in. rod mill and the 9-in. wire mill. Two tilting tables and three roll lathes were placed with the United Engineering & Foundry Co.

Otherwise the business of the year was of such equipment as was absolutely needed and then largely for replacement. There was so much uncertainty to prices that those projecting new plants or extensions requiring tools or machinery were encouraged to delay. Price reductions were frequent by machine tool manufacturers during the first half of the year and though public announcements were lacking during the last half, the market remained in buyers' favor, due to the fact that there was not enough business to go around and competition was keen for passing business. Builders of cranes, mills and heavy equipment generally, have had to pare prices pretty sharply to secure business lately. Crane prices which prior to the war averaged a little less than 10c. per lb. and during the war and the post-war boom of 1920 went above 20c. per lb. now are back at about 10c. per lb. on the basis of prices which have leaked out on some recent awards. Incidentally, as bearing on the future demand for

cranes and parts from steel manufacturers, some now are building their own. On all recent purchases made by the Carnegie Steel Co. the manufacturer has been obliged to furnish blueprints of the crane and parts and there is now more than one crane in use by this company which it has built itself. Railroad buying has been practically nil in the Pittsburgh district the past year.

The Week's Market

New York

NEW YORK, Jan. 3.

Late last week the purchasing department of the Delaware, Lackawanna & Western Railroad began calling to its offices the representatives of machine-tool builders preparatory to placing orders against its recent list of about 40 machines. It is expected that all of its business will be placed this week. The Seaboard Air Line last week bought about $30,000 worth of machine tools, most of the business going to one New York company which specializes in railroad tools. Two turret lathes were ordered from a Cleveland builder.

The last week of 1921 was otherwise dull, but prospects were somewhat improved. A better demand for turret lathes is in evidence, one company's December business in this district having shown quite a marked improvement.

The crane market in this section was featureless the past week. The 34 gantry cranes for the New York City piers at Stapleton, S. I., were awarded to the Wellman-Seaver-Morgan Co., low bidders on the second bidding, with a price of $276,268. On the other three items of the tender the following awards were made, based on the first bids submitted: B. Gurney Elevator Co., 300 Eighth Avenue, New York; C. Watson Flagg Engineering Co., 123 Liberty Street, New York, electric power wiring; D. Shevlin Engineering Co., 110 West Thirty-fourth Street, steam-heating equipment. The H. S. Jones Building Co., 280 Madison Avenue, New York, holding a contract for construction work awarded by the Passaic Valley Sewage Commission, has purchased a 15-ton hand power crane from the New Jersey Foundry & Machine Co., which was the low bidder on a recent inquiry. The Coleman-Shoemaker Co., Philadelphia, recently in the market for a 10-ton, 28-ft. span hand power crane, has purchased. The West Jersey Supply & Sand Corporation, Beach & Marlborough streets, Philadelphia, has purchased a 25-ton Orton & Steinbrenner locomotive crane.

The Warner-Quinlan Co., 79 Wall Street, New York, has awarded contract to the John W. Ferguson Co., Paterson, N. J., for eight fireproof buildings at Linden, N. J., to replace its asphalt manufacturing plant, recently destroyed by fire with loss estimated at close to $1,500,000. The work will include a power plant, machine repair shop and other works buildings. The Hammond Iron Works, Warren, Pa., has received a contract for steel tanks at the new plant, which is estimated to cost about $1,000,000, including machinery. The Gifford, Huntz, Baker Engineering Corporation, 40 Rector Street, New York, is engineer.

The New York Central Railroad Co., Grand Central Terminal, New York, has plans nearing completion for enlargement of its car repair shops at West Albany, N. Y. The work will be carried out in connection with a $20,000,000 expansion and improvement program in this section.

The Muglers Iron Works, Inc., 796 East 133rd Street, New York, will build a one-story addition, 50 x 105 ft. Plans have been filed.

A vocational department will be installed in the two-story high school to be erected by the Board of Education, Maybrook School District, Maybrook, N. Y., estimated to cost about $110,000. Frederick Eicholtz is president of the board. H. T. Blanchard, 137 East Forty-sixth Street, New York, is architect.

The Grosser Knitting Machine Co., 260 West Broadway, New York, manufacturer of knitting machinery and parts, has leased the eight-story factory at 248-50 West Broadway, totaling about 38,000 sq. ft., for a new plant. The present works will be removed to this location.

The New York Edison Co., Irving Place and Fifteenth Street, New York, will commence the immediate erection of a two-story power house, 38 x 126 ft., at Park Avenue and 188th Street, estimated to cost about $75,000.

The Board of Aldermen, New York, has approved an appropriation of $900,000 for a new pier on the North River, replacing Pier No. 32. The Department of Docks, Municipal Building, will be in charge.

A one-story power house will be erected by the St. Joseph's Infant Home, Green Street, Utica, N. Y., in connection with a new mechanical laundry building, estimated to cost about $45,000.

The Manhattan Roofing Co., 133 East 118th Street, New York, has acquired the building now occupied and plans the erection of a new six-story structure for general expansion.

The A. A. Garage, Inc., has leased a two-story building on Avenue A, between Sixtieth and Sixty-first Street, New York, for an automobile service and repair works. C. R. Warren and H. Williams head the company.

The American Insulation Co., 9 New Jersey Railroad Avenue, Newark, N. J., manufacturer of roofing, etc., with headquarters at Roberts and Stokly streets, Philadelphia, has leased the one-story building at 128-34 Jackson Street, and will remove its local works to this location. The property is owned by the Bassick Co., Bridgeport, Conn., manufacturer of casters, etc.

The Wittemann Aircraft Corporation, Hasbrouck Heights, N. J., and other airplane manufacturing interests, are negotiating with the Department of Streets and Public Improvements, Newark, for a site at Port Newark, for the establishment of a plant to manufacture aeroplanes and other aircraft and parts. As projected the plant will cost in excess of $1,000,000. Paul Wittemann is head of the company.

The Central Ice & Cold Storage Co., Vineland, N. J., has completed plans and will soon break ground for a new one-story ice-manufacturing plant at Sixth and Pear streets, estimated to cost about $250,000, including machinery. A. L. Williams is president.

The Borough Council, Butler, N. J., has disposed of a bond issue of $76,700, for the construction of an addition to the municipal electric power plant.

The Somerset Electric Co., Morristown, N. J., will acquire and merge the plants and properties of the United Electric Co., and the Boonton Electric Co., Boonton, N. J., and has issued a bond issue of $450,000 for this purpose. It is proposed to make improvements and extensions in the present plants and system.

New England

BOSTON, Jan. 2.

The final week of 1921 was quiet in the local machine-tool market. Anticipated closing on crane business did not materialize, being put off for another week or ten days. Three or four houses monopolized the business which appeared and about 80 per cent of the equipment purchased was used machinery. Sales for the week include a 20-in. lathe and a 20-in. planer, both used tools, to a Weirs, N. H., consumer; a new Garvin screw slotter, to a Bangor manufacturer; a 28-in. used Prentice drill, and a used 7500-lb. hammer to a local street railroad company; a used Brown & Sharpe vertical milling machine and other equipment to a Lowell textile machinery maker. A small amount of export business was put through for Cuba, including a used 24 x 24-in. x 6 ft. planer, a 9-in. x 4 ft. Seneca Falls lathe and miscellaneous used equipment. The L. B. Smith Co., H and Fourth streets, South Boston, silversmiths, is in the market for fairly heavy press equipment, either new or used. About the only other new business to develop is an inquiry for two large back geared lathes and several less expensive turning tools.

A number of old prospects, considered more or less uncertain have become active once more, one involving approximately $20,000 worth of presses and another a moderately large list of shop equipment for a New England street railroad company. With the revival of such prospects, added to those considered alive, local machine tool houses are confident good bookings will be made in January and February. Dealers in most other sections of New England are less hopeful, although in Providence the outlook for used tools, at least, is looked upon as encouraging. No changes in prices are reported this week. The local trade, however, anticipates some adjustments within the next fortnight.

The Gilbert & Barker Mfg. Co., Springfield, Mass., tanks, etc. contemplates additions, but details have not been worked out.

The Gilbert & Barker Mfg. Co., Springfield, Mass., tanks, Haven, Conn., plans the erection of a one-story factory, 140 x 160 ft., to cost approximately $100,000.

In the interest of economy, the Hill plant, Springfield Armory, Springfield, Mass., is to be abandoned by the

Government as a manufacturing unit and will be leased to outside interests.

The Textile Finishing Machinery Co., 171 Westminster Street, Providence, R. I., will commence the immediate erection of its proposed plant on Harris Avenue, consisting of two buildings, one of which will be equipped as a machine shop.

The Segal Metal Products Co., Springdale, Stamford, Conn., is planning to rebuild the portion of its plant, destroyed by fire, Dec. 21, with loss reported at about $15,000. The structure had been occupied only about a week by the Segal company for the manufacture of locks and kindred specialties.

The Connery Machine & Tool Co., Springfield, Mass., has preliminary plans under way for a new one-story plant, 50 x 150 ft., on property recently acquired on Fisk Avenue.

The Builders' Iron & Steel Co., 262 Bridge Street, Everett, Mass., has work under way on the superstructure for its new one-story plant, 25 x 70 ft., estimated to cost about $65,000.

The Robert M. Keating Co., Springfield, Mass., is arranging for the manufacture of an improved type of flush valve on a quantity basis at its plant at an early date. Tools and equipment for the production are now being developed.

John McGann and Raymond Handrahan, Waltham, Mass., have acquired a building at Charles and Harvard streets, for the establishment of a machine repair works, primarily for automotive service.

Chicago

CHICAGO, Jan. 3.

A little business was closed between the holidays but if all users who have promised to take action on their needs after the first of the year actually make purchases, the coming month should be an active one. Not only the railroads, but miscellaneous users, have indicated that they expect to buy equipment. Among the railroads the Santa Fe and the Rock Island are regarded as most likely to place their requirements in the near future. The Union Pacific which was reported to have prepared an extensive list has thus far merely asked for quotations for the purpose of preparing a 1922 budget. The Burlington is preparing to enter the market for extensive needs, the most important of which will be the requirements of a new shop to be built near Denver for the Colorado & Southern, its subsidiary.

The Growoiz Artificial Ice Co., 1018 South Hamilton Avenue, Chicago, has secured a permit for the construction of a one-story plant, 124 x 165 ft., at 3916-28 W. Harrison Street, to cost $36,000.

The Great Northern Railway Co., St. Paul, F. A. Bushnell, purchasing agent, is inquiring for a Niagara 12-ft. squaring shear and a Chicago 12-ft. brake, but bids on competitive machines are invited.

The construction of a plant of the American Locomotive Co. at Granite City, Ill., is believed to be imminent, as temporary structures for engineers in charge of design and construction are now being erected on the company's property in that city.

The Nelson Knitting Co., 660 South Wyman Street, Rockford, Ill., plans to construct a three-story knitting factory on Kent Street near Church Street, at a cost of $75,000.

The Globe Portland Cement Co. has let a contract for a large cement plant at Dubuque, Iowa, at a reported cost of $2,000,000.

The Monticello Tire & Rubber Co., Monticello, Iowa, is constructing a 60 x 190-ft. tire plant to cost $20,000.

The Henry Artificial Ice Co., Henry, Ill., is having plans prepared for a one-story artificial ice plant to cost $30,000.

Temporary repairs have been made to the plant of the West Michigan Steel Foundry Co., Muskegon, Mich., which was damaged by fire Dec. 14. Permanent repairs will not be made until next spring. The fire loss totaled $28,000, of which $11,000 was in the structure, and $17,000 in equipment and supplies.

The Haskell & Barker Car Co., Michigan City, Ind., has taken bids on a foundry addition.

The J. A. Huetter Machine Co., 545 Kentucky Avenue, Indianapolis, is preparing plans for a one-story machine shop, 55 x 85 ft., to cost $25,000.

C. A. Starr, 137 Park Place, Decatur, Ill., plans to construct a one-story automobile repair shop, 75 x 162 ft., to cost $40,000.

G. C. Brown and W. C. Gridley, 1826 Hoffman Boulevard, Rockford, Ill., are having plans drawn for a one-story garage, 60 x 145 ft., a repair shop, 35 x 60 ft., and a boiler plant, 20 x 30 ft., on Auburn Avenue, to cost $75,000.

The Oetting Brothers Ice Co., 1725 West Fifteenth Street, Chicago, is taking bids for a new two-story and basement plant, 80 x 180 ft., on Fifteenth Street. Edward G. McClellan, 7441 Cottage Grove Avenue, is architect.

The Pratt Brothers Mining Co., Herrin, Ill., operating the Jeffrey mine, is considering the rebuilding of the tipple at its property, recently destroped by fire.

Fire, Dec. 24, destroyed the plant of the Teetoe Adding Machine Co., occupying the larger portion of a five-story building, with loss reported in excess of $500,000, including machinery.

The Great Northern Power Co., Duluth, Minn., is considering the construction of a new hydroelectric generating plant in the vicinity of Fond du Lac, Minn., estimated to cost in excess of $1,500,000.

The Monticello Tire & Rubber Co., Monticello, Iowa, has filed plans for the erection of a new one-story plant, 60 x 160 ft., to be equipped for the manufacture of automobile tires and other rubber products.

A vocational department will be installed in the new two-story and basement high school to be erected by the Board of Education, Consolidated District, Reinbeck, Iowa, estimated to cost about $250,000. Bids will be taken at once. Netcott, Donnon & Netcott, Black Building, Waterloo, Iowa, are architects.

Philadelphia

PHILADELPHIA, Jan. 2.

Horace T. Potts & Co., 316-20 North Third Street, Philadelphia, manufacturers of iron and steel products, will defer until early spring the construction of their new foundry and iron-working buildings at Erie Avenue and D Street, contract for which was awarded to the William Steele & Sons Co., 1600 Arch Street. The plant will cost in excess of $100,000.

The F. Weber Co., 1220 Buttonwood Avenue, Philadelphia, manufacturer of drawing instruments and precision products, has awarded contract to the A. Raymond Raff Co., 1635 Thompson Street, for rebuilding the portion of its plant recently destroyed by fire. The construction will cost about $30,000.

The Energy Elevator Co., 214 New Street, Philadelphia, manufacturer of freight elevators, etc., has taken title to property adjoining its plant for extensions.

A two-story power plant, 53 x 60 ft., will be erected by the board of directors, St. James Mercy Hospital, Chester, Pa., in connection with a new four-story hospital. Bids will be asked early in January. F. F. Durang, 1220 Locust Street, Philadelphia, is architect.

The Allen Iron & Steel Co., Third and Venango streets, Philadelphia, has filed plans for a new one-story building, for general works service, estimated to cost about $13,000. The Austin Co., Bulletin Building, is contractor.

A vocational department will be installed in the three-story and basement senior and junior high school to be erected by the Radnor Township School District, 115 North Wayne Avenue, Wayne, Pa., estimated to cost about $150,000. H. C. Richards, 608 Chestnut Street, Philadelphia, is architect.

The Shippers' Car Line, Milton, Pa., a subsidiary of the American Car & Foundry Co., operating a local tank car repair plant, is planning to rebuild the portion of the works destroyed by fire, Dec. 22, with loss of about $25,000. The fire was confined for the most part to the shearing department and washer shop.

The Frick Co., Waynesboro, Pa., manufacturer of agricultural implements and parts, will soon take bids for a one-story addition, 50 x 100 ft., to be used as an erecting shop and for engine production. A. O. Frick is vice-president and general manager.

The E. Keeler Co., Williamsport, Pa., manufacturer of stationary steam boilers, etc., is considering the erection of a one and two-story addition.

The Swedesboro Ice & Cold Storage Co., Swedesboro, Philadelphia, has awarded contract for its new ice-manufacturing and cold storage plant to William F. Koelle & Co., Twenty-sixth and Oxford streets, Philadelphia, and work will commence at once. It is estimated to cost about $100,000.

The Hanover Automobile Co., Hanover, Pa., occupying the former plant of the General Gas & Electric Co., is planning for enlargements to provide for a capacity of 1000 cars a month, designed to sell for about $300 each. It is expected to give employment to about 1500 operatives.

Baltimore

BALTIMORE, Jan. 2.

The Parker Metal Decorating Co., Howard and Ostend streets, Baltimore, has filed plans for a one-story factory, 60 x 69 ft., to replace a portion of its works recently destroyed by fire.

The Board of Works, Baltimore, is considering tentative plans for a central machine and repair shop for municipal departments. Edward G. Rost, City Hall, is mechanical superintendent.

Officials of the S. B. Sexton Stove & Mfg. Co., 501 West Conway Street, Baltimore, have organized the Isaac A. Sheppard Co., to succeed the former company of that name and whose plant, known as the Excelsior Stove Works at Chester and Eastern avenues, was purchased recently by the Sexton company under a bankruptcy sale. The new company will be capitalized at $2,100,000 and will operate at the plant for the manufacture of stoves, stove castings, heating and cooking equipment, ventilating apparatus, etc. The incorporators are Charles S. Austin, Jesse N. Bowen and Arthur W. Baker. The registered agent is Clarence K. Sexton, address noted.

The Bostwick-Lyon Bronze Co., Waynesport, Pa., operating the Hagerstown Bearing Metal Works, Hagerstown, Md., as a branch plant, has purchased the plant and business of the Maryland Smelting & Refining Co., Hagerstown. The company will be merged with the Hagerstown Bearing Metal Works and the plant used for expansion.

The State Board of Prison Control, Baltimore, has plans under way for a two-story mechanical and industrial shop at the Maryland House of Correction, Bridewell, Md., 45 x 150 ft., estimated to cost about $40,000. Theodore W. Pietsch, American Building, Baltimore, is architect.

The Palmetto Concrete Mfg. & Machinery Co., 1422 Henderson Street, Columbia, S. C., has completed plans for two new buildings, 40 x 100 ft. and 30 x 90 ft., and will commence work soon. H. C. Randolph is president.

The Jarvis Storage Battery Co., 229 South Liberty Street, Winston-Salem, N. C., recently organized with a capital of $50,000, has plans under way for a new one-story factory to manufacture storage batteries. A site has been purchased. G. C. Jarvis is president, and O. F. Brown, vice-president.

The Georgia Railway & Power Co., Atlanta, Ga., is arranging for a bond issue of $13,000,000, about $8,000,000 of which will be used for electric plant extensions and improvements. A program has been arranged to include the completion of a hydroelectric generating plant on the Tugalo River, with capacity of about 80,000-hp.; enlarging the generating plant at Morgan Falls, new electrical equipment, etc. Harry M. Atkinson is chairman of the board.

The Norfolk & Western Railway Co., Roanoke, Va., will build a new coaling plant at Williamson, W. Va., to cost about $75,000, including mechanical equipment.

The Richmond Car Works, Richmond, Va., recently organized, has taken title to the Government plant at South Richmond for $220,000, orginally designed as a marine boiler plant for the United States Shipping Board. The site totals 52 acres, with main building, 180 x 600 ft. It will be equipped at once for the manufacture of steam and electric cars and other products. Lewis C. Williams is president.

Pittsburgh

SEATTLE, Dec. 20.

The closing week of the old year was featured by at least one good-sized order, namely, the mill-drives for a blooming mill and a continuous mill at the Steubenville, Ohio, plant (LaBelle Works), of the Wheeling Steel Corporation. This order, placed through the Dravo-Doyle Co., Pittsburgh, is for two Nordberg four-cylinder uniflow engines. Generally, business in machinery and equipment has been quiet, but this is merely looked upon as a seasonal condition and the common expectation is that some action will be taken on pending business as soon as the inventory period is out of the way. There have been no crane awards the past week, but a number of inquiries are regarded as near the closing stage and buyers are believed to be holding back orders chiefly to put the purchases on 1922 accounts. It is said that the Niles-Bement-Pond Co. submitted the lowest bid against the inquiry of the Elliott Co., Jeannette, Pa., for a 50-ton overhead with 10-ton auxiliary and span of 58 ft. 6 in. The Universal Steel Co., Bridgeville, Pa., has placed an order with Manning, Maxwell & Moore, Inc., for two Chambersburg hammers, one a 1500-lb. steam drop hammer and the other a 1200-lb. board drop, hammer. The Allis-Chalmers Mfg. Co., has taken an order for a Barr chain grizzley for the Jones & Laughlin Steel Co., for its ore mining subsidiary, the Interstate Iron Co.

Cincinnati

CINCINNATI, Jan. 2.

There have been few developments in the machinery market the past week. The Chicago, Burlington & Quincy Railroad issued a list which is now being figured on. With this exception new inquiries are at a low rate. Few orders have been booked, the largest consisting of a number of wood-working machines bought by a Middle Western railroad. No action has been taken on the C. & O. list or the one issued by the Rock Island. The Louisville & Nashville Railroad is expected to close this week on a number of tools recently inquired for.

With the passing of 1921, one of the poorest years in the machine tool industry for the past decade has been closed. Many of the smaller manufacturers of tools have been shut down since last spring and only skeleton forces are employed in many of the larger ones. Some plants have been able to maintain a fair rate of operation, but on an average the machine tool industry during the year did not exceed 25 per cent of capacity. However, while the year was poor, orders booked during December, and the number of live inquiries still outstanding, have somewhat encouraged manufacturers who now feel confident that the turning point has been passed and a steady improvement will be forthcoming.

The Central South

ST. LOUIS, Jan. 2.

The Superior Ice & Storage Co., Lee Building, Kansas City, Mo., will break ground at once for a new ice-manufacturing plant, with a daily capacity of about 100 tons. It is estimated to cost approximately $100,000. A. L. Williams is head.

The Mobile & Ohio Railroad Co., St. Louis, will install a new coal and cinder handling plant at its yards at Jackson, Tenn., estimated to cost about $25,000.

The Board of Directors, University of Missouri, Columbia, Mo., is completing plans and will soon call for bids for a one-story and basement power plant, estimated to cost about $150,000. James P. Jamieson, Security Building, St. Louis, is head of the board.

At a special election, Dec. 21, at Lawton, Okla., bonds were approved for $600,000 for the construction of a municipal electric power plant and distributing system.

The Harlan Ice & Refrigerator Co., Harlan, Ky., is planning the erection of a new one-story factory. It recently increased its capital to $100,000 for expansion.

A vocational department will be installed in the new high school to be constructed at Flat River, Mo., estimated to cost about $100,000. J. H. Felt & Co., Temple Building, Kansas City, Mo., are architects.

The International Harvester Co., 606 South Michigan Avenue, Chicago, will rebuild the portion of its repair shops at Salina, Kan., and will break ground at once. The new structure will cost close to $20,000, exclusive of equipment.

Seattle

PITTSBURGH, Jan. 2.

The Chehalis Box, Basket & Veneer Co., Chehalis, Wash., has completed plans for the rebuilding of its factory at North Chehalis, and proposes to commence work soon. It will be equipped for a capacity of 20,000 boxes per day, and is estimated to cost close to $90,000, including machinery. L. J. Sticklin is president.

A. M. Elliott, Vancouver, Wash., formerly connected with the B. F. Goodrich Co., Akron, Ohio, is organizing a company to establish a plant to manufacture automobile tires and tubes. The local Commercial Club is interested in the project, and a site is being selected.

The Elmore Copper Co., Mountain Home, Idaho, has been granted permission to construct a dam and hydroelectric power plant on the South Fork of the Boise River, about 25 miles north of the Arrowhead dam. It is said that the project will cost in excess of $100,000.

The Common Council, Yamhill, Ore., is considering the construction of a municipal electric lighting plant.

The Airo Metal Products Co., Yakima, Wash., has acquired the plant and business of the Crimp-Hards Mfg. Co., Ellensburg, Wash., manufacturer of automatic pumps and parts. The business will be continued at the present location until spring, when it will be removed to the Yakima works. The latter plant will be enlarged.

The Board of Directors, University of Montana, Bozeman, will take bids until Jan. 14 for the construction of

new engineering building and shops. On Jan. 21, bids will be opened for power house equipment at the college. An appropriation of $1,400,000 is available for these and other extensions.

The Gulf States

BIRMINGHAM, Jan. 2.

The Humphreys-Pure Oil Refineries Corporation, Mexia, Tex., has been incorporated under Delaware laws with capital of $50,000,000 to build a local refinery. It is an affiliation of the Humphreys-Mexia Co. and the Pure Oil Co. Plans are under way for the erection of a refinery in the vicinity of Dallas, Tex., and pipe line to the Gulf, estimated to cost close to $5,000,000, complete. Col. E. A. Humphreys is one of the heads of the company.

The Wilson Hydraulic Casing Machine Co., Clarksburg, W. Va., Daniel Howard, head, is planning the construction of a one-story machine works at Burkburnett, Tex., to manufacture machine equipment for oil well service.

The Leesburg Pulp Mill, Leesburg, Fla., is planning for enlargements to double the present capacity. Considerable new machinery will be installed.

The Wichita Motors Co., Wichita, Tex., is arranging for the manufacture of cotton-picking machinery at its plant, to be marketed as the Price-Campbell cotton picker. Parts production and assembling will be carried out at the works. J. G. Culbertson is president.

Henry and James Coyle, Huntsville, Ala., are organizing a company to establish a plant to manufacture spark plugs of special type and other ignition equipment.

The Maddox Foundry & Machine Co., Archer, Fla., is considering the erection of a new one-story foundry, 40 x 50 ft. H. Maddox is general manager.

The Common Council, St. Augustine, Fla., is planning for a bond issue of $30,000 for the establishment of a municipal electric light and power plant. Plans will be prepared at an early date.

California

SAN FRANCISCO, Dec. 20.

The Tunison Motor Co., Hayward, Cal., is perfecting plans for the erection of a new plant at Oakland, Cal., to manufacture automobiles. It is proposed to produce all equipment and parts, with the exception of bearings, electrical accessories and minor equipment. A. W. Beam, head of the local Chamber of Commerce, was recently elected president of the company. George H. Reuben is general manager.

The Terminal Iron Works, Stockton, Cal., recently organized, has acquired the plant and business of the Stockton Iron Works, and will operate the property. An adjoining site has been leased for an addition. Harry W. Fawke, formerly superintendent of the Moore Shipbuilding Co., is head.

A vocational department will be installed in the high school to be erected by the Board of Education, Orange, Cal., estimated to cost about $130,000. Allison & Allison, Hibernian Building, Los Angeles, are architects.

The Great Western Power Co., 14 Sansom Street, San Francisco, has tentative plans for a new hydroelectric generating plant in the vicinity of Oroville, Cal., estimated to cost about $2,000,000.

The Automatic Electric Machine Co., San Francisco, manufacturer of automatic dating and canceling machines and parts, is planning the erection of a new factory at Oakland, Cal., where a site has been selected. It is proposed to commence work at an early date. H. G. Lundgren is president.

The Board of Education, Lodi, Cal., has instructed William Inch, principal of the Union High School, to have plans prepared for a new mechanical and manual training shop at the present school, in connection with a proposed science building.

Mallory Brothers, Santa Rosa, Cal., operating a general machine works, are planning the erection of a new reinforced-concrete machine and forge shop. The present works will be removed to the structure upon completion and additional equipment installed.

The Sugar Pine Lumber Co., First National Bank Building, San Francisco, has plans under way for a new lumber mill on the San Joaquin River, near Fresno, estimated to cost about $2,000,000, including power plant, machinery, etc. The company will also build a railroad, estimated to cost approximately a like amount, including locomotives and other rolling stock. Elmer H. Cox is president.

The Board of Supervisors of Santa Clara County, San Jose, Cal., will build a new power house and cold storage plant at the County Hospital.

Cleveland

CLEVELAND, Jan. 2.

While orders are light machine tool manufacturers report considerable improvement in inquiry which is in marked contrast with the holiday period a year ago when everything in machinery lines was flat. Makers of automatic machinery have recently received a number of inquiries ranging from single tools up to lots of 10 machines, mostly from the automobile and allied industries. Makers of screw machinery and turret lathes are getting some orders from the brass and other industries and report an improvement in inquiries. A local manufacturer has taken an order from the Hudson Motor Car Co. for two automatic screw machines and another order for two machines from the Seaboard Airline Railroad.

Local dealers state that the holiday week has had little effect on the market as the volume of business has kept up at about the recent rate. There is a moderate inquiry for from one to four machines. The demand is largely for small machines and the prospective buyers usually favor used tools. Considerable of the inquiry is coming from small machine shops doing repair work.

The General Motors Corporation is still shipping its surplus machinery to Detroit and it is expected that this will be placed on the market early in January. The number of machines, originally estimated at 1600, has been increased to 2500 to 3000. However, as the machines are shipped in, superintendents of the various General Motors plants are picking out tools that have come from other plants that they can use so that the total number to be placed on the market may not be much over 2000. These will be sold through dealers.

The Sandusky Cement Co., Engineers Building, Cleveland, will shortly place contracts for the erection of a new cement plant near Toledo, Ohio. It will probably include three buildings of steel construction. Complete equipment will be purchased. Three overhead traveling cranes with 80-ft. span and approximately 10-ton capacity to handle three yard buckets will be required. An inquiry for the cranes has already been sent out.

Milwaukee

MILWAUKEE, Jan. 3.

Although sales in the last week to 10 days were small, inquiry was unusually active, considering the period, and it appears very likely that orders on these will mature shortly. Makers of milling machines expect renewed interest from the automotive and agricultural implement industries. The former have been buying on a small scale, while the latter were out of the market the greater part of the past year. A hopeful sign for all classes of tool business is that new enterprises are again being established, due to the easier financial situation. At present their requirements are only relieving the used tool situation and then only to a limited extent.

The Sunby Battery Co., Milwaukee, has been organized with an authorized capital stock of $500,000 to manufacture storage batteries and similiar specialties. The principals are represented by Emil J. Gehrz and Walter Schinz, Jr., attorneys, 105 Wells Street, who for the present will not reveal the identity of the promoters or issue details concerning the enterprise.

The Starcast Aluminum Co., Milwaukee, has been incorporated with a capital stock of $10,000 to manufacture aluminum parts and specialties. The incorporators are Nicholas A. Boehm, president and treasurer Wisconsin Brass Foundry Co., 1664-1674 Fratney Street, Helen C. Boehm, and Herman Beckman, superintendent of the brass company.

The Board of Education, Clear Lake, Wis., has engaged Edwins & Edwins, 911 Northwestern Building, Minneapolis, Minn., to design a new high school with manual training facilities, to cost not more than $125,000. Bids will be taken about Jan. 15. J. Enderholm is clerk of the board.

The Combination Door & Screen Co., 180 Ruggles Street, Fond du Lac, Wis., has let the general contract to the Hutter Construction Co., local, for a two-story brick and concrete addition, 50 x 75 ft., estimated to cost $30,000 with new equipment.

The Automatic Railway Gate Co., Milwaukee, has been incorporated with a capital stock of $5,000 to manufacture safety devices for railroad crossings. The incorporators are Frank P. Mansfield, 426 Thirty-first Street, and Ottmar Kloetzner, Jr., and Gilbert Lappley, attorneys, 1414 Grand Avenue, Milwaukee. No plans have as yet been made for the establishment of a factory.

The Iola, Wis., Board of Education has plans by Edward Tough, architect, Madison, Wis., for a three-story addition, 52 x 78 ft., to the high school, part of which will be equipped for vocational training. F. C. Wipf is secretary.

Current Metal Prices

On Small Lots, Delivered from Merchants' Stocks, New York City

The quotations given below are for small lots, as sold from stores in New York City by merchants carrying stocks.

As there are many consumers whose requirements are not sufficiently heavy to warrant their placing orders with manufacturers for shipment in carload lots from mills, these prices are given for their convenience.

On a number of articles the base price only is given, it being impossible to name every size.

The wholesale prices at which large lots are sold by manufacturers for direct shipment from mills are given in the market reports appearing in a preceding part of THE IRON AGE under the general heading of "Iron and Steel Markets" and "Non-ferrous Metals."

Iron and Soft Steel Bars and Shapes

	Per Lb.
Bars:	
Refined bars, base price	2.68c.
Swedish bars, base price	10.00c.
Soft steel bars, base price	2.68c.
Hoops, base price	3.53c.
Bands, base price	3.28c.
Beams and channels, angles and tees 3 in. x ¼ in. and larger, base	2.78c.
Channels, angles and tees under 3 in. x ¼ in., base	2.68c.

Merchant Steel

	Per Lb.
Tire, 1½ x ½ in. and larger	2.65c.
(Smooth finish, 1 to 2½ x ¼ in. and larger)	2.85c.
Toe calk, ½ x ⅜ in. and larger	3.25c.
Cold-rolled strip, soft and quarter hard	6.25c. to 7.25c.
Open-hearth spring steel	3.75c. to 6c.
Shafting and Screw Stock:	
Rounds	3.55c.
Squares, flats and hex	4.05c.
Standard cast steel, base price	12.00c.
Extra cast steel	17.00c.
Special cast steel	22.00c.

Tank Plates—Steel

	Per Lb.
¼ in. and heavier	2.78c.

Sheets

Blue Annealed

	Per Lb.
No. 10	3.28c. to 3.53c.
No. 12	3.33c. to 3.58c.
No. 14	3.38c. to 3.63c.
No. 16	3.48c. to 3.73c.

Box Annealed—Black

	Soft Steel C. R., One Pass Per Lb.	Blued Stove Pipe Sheet, Per Lb.
Nos. 18 to 20	3.80c.	.....
Nos. 22 and 24	3.85c.	4.10c.
No. 26	3.90c.	4.15c.
No. 28	4.00c.	4.25c.
No. 30	4.25c.	.....

No. 28 and lighter, 36 in. wide, 10c. higher.

Galvanized

	Per Lb.
No. 14	3.95c. to 4.10c.
No. 16	4.10c. to 4.25c.
Nos. 18 and 20	4.25c. to 4.40c.
Nos. 22 and 24	4.40c. to 4.55c.
No. 26	4.55c. to 4.70c.
No. 27	4.70c. to 4.85c.
No. 28	4.85c. to 5.00c.
No. 30	5.35c. to 5.50c.

No. 28 and lighter, 36 in. wide, 20c. higher.

Welded Pipe

Standard Steel	Black	Galv.	*Wrought Iron*	Black	Galv.
½ in. Butt	—56	—40	¾-in. Butt	—30	—13
¾ in. Butt	—61	—47	1½-in. Butt	—32	—15
1-3 in. Butt	—63	—49	2-in. Lap	—27	—10
3½-6 in. Lap	—60	—46	2½-6-in. Lap	—30	—15
7-8 in. Lap	—56	—34	7-12-in. Lap	—23	— 7
9-12 in. Lap	—55	—33			

Steel Wire

BASED PRICE* ON NO. 9 GAGE AND COARSER	Per Lb.
Bright basic	4.00c.
Annealed soft	4.00c.
Galvanized annealed	4.75c.
Coppered basic	4.50c.
Tinned soft Bessemer	6.00c.

*Regular extras for lighter gage.

Brass Sheet, Rod, Tube and Wire

BASE PRICE

High brass sheet	17¼c. to 17½c.
High brass wire	17¼c. to 17½c.
Brass rod	14¾c. to 15 c.
Brass tube, brazed	26 c. to 27½c.
Brass tube, seamless	18½c. to 19 c.
Copper tube, seamless	21¼c.

Copper Sheets

Sheet copper, hot rolled, 24 oz., 21½c. per lb. base.

Cold rolled, 14 oz. and heavier, 2c. per lb. advance over hot rolled.

Tin Plates

Bright Tin		Coke—14-20		
	Grade "AAA" Charcoal 14x20	Grade "A" Charcoal 14x20		Primes	Wasters
IC	$10.00	$8.50	80 lb.	$6.05	$5.80
IX	11.25	10.00	90 lb.	6.15	5.90
IXX	13.00	11.50	100 lb.	6.25	6.00
IXXX	14.75	13.25	IC	6.40	6.15
IXXXX	16.25	15.00	IX	7.40	7.15
			IXX	8.40	8.15
			IXXX	9.40	9.15
			IXXXX	10.40	10.15

Terne Plates

8-lb. Coating 14 x 20

100 lb.	$7.00
IC	7.25
IX	7.50
Fire door stock	10.00

Tin

Straits, pig	35c.
Bar	40c. to 45c.

Copper

Lake ingot	16 c.
Electrolytic	15¾c.
Casting	15¼c.

Spelter and Sheet Zinc

Western spelter	6½c. to 7c.
Sheet zinc, No. 9 base, casks	10½c. open 11c.

Lead and Solder*

American pig lead	5¾c. to 6¼c.
Bar lead	6¾c. to 7 c.
Solder, ½ and ½ guaranteed	27c.
No. 1 solder	25c.
Refined solder	21c.

*Prices of solder indicated by private brand vary according to composition.

Babbitt Metal

Best grade, per lb.	80c.
Commercial grade, per lb.	40c.
Grade D, per lb.	35c.

Antimony

Asiatic	6½c. to 6¾c.

Aluminum

No. 1 aluminum (guaranteed over 99 per cent pure), in ingots for remelting, per lb.	29c. to 31c.

Old Metals

The market continues strong with practically no change in values. Dealers' buying prices are nominally as follows:

	Cents Per Lb.
Copper, heavy crucible	11.25
Copper, heavy wire	10.75
Copper, light and bottoms	8.25
Brass, heavy	5.50
Brass, light	4.50
Heavy machine composition	8.00
No. 1 yellow brass turnings	5.50
No. 1 red brass or composition turnings	7.00
Lead, heavy	3.75
Lead, tea	2.50
Zinc	2.50